The

Electrical Review

VOL. XCIX. NOVEMBER 26, 1926. No. 2,557.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.Inst.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C. Telephone No.: Central 7072 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
The Electrical Industry: a Survey	861
Radio Trade Organisation	862
The Beama Dinner	862
Electricity in Rural Sweden	863
The Volta Centenary Celebrations	863
The Valuation of Street-lighting Service	863
Colliery Electrification, by G. S. Bowden (*illus.*)	864
Extra-high-pressure Aerial Lines, by Theodore Rich (*illus.*)	866
Electricity Supply in Great Britain—XVIII	868
The Complete Salesman	869
Lightning Discharges, by T. C. Gilbert	870
Rendering Machinery Sound-proof (*illus.*)	872
Rural Electrification in Sweden, by Alfred Ekstrom (*illus.*)	873
Business Notes	874
Lighting and Power Notes	879
Tramway and Railway Notes	880
Telegraph and Telephone Notes	880
Radio Notes	881
Contracts Open and Closed	881
Forthcoming Events	882
Notes	882
Institution Notes	885
Our Personal Column	885
New Companies Registered	886
Official Returns of Electrical Companies	886
City Notes	887
Stocks and Shares	887
Some Electrical Problems, by W. W. E. French (*illus.*)	889
Electricity in Coal Mines	890
The Situation in China	891
Some Economic Problems, by Col. J. F. Lister	891
New Electrical Devices, Fittings, and Plant (*illus.*)	892
Electric Locomotives, by T. A. F. Stone	893
Hydro-electric Power, by Prof. F. Bacon	894
Parliamentary News	894
Electrical Gifts for Christmas—I (*illus.*)	895
The Beama Dinner	896
Industrial Standardisation	897
Shop Window Display	897
Correspondence—	
Variable-speed Three-phase Motors	898
Wiring for Domestic Appliances	898
Wiring the Homes of Britain: an Appeal	898
Overhead Transmission Lines	899
The Rent Meter	899
Change of Voltage	899
The Ironmongers' Exhibition	900
Trade-Mark Applications	900
Published Specifications	900
Contractors' Column	Advertisement page xxxiv

The Electrical Industry: A Survey.

THE B.E.A.M.A. through its Economic and Statistical Department has rendered a service to the electrical trade by the publication of the first of a series of Quarterly International Studies of Trade Conditions. It is dated December, and is obtainable at the offices, 36, Kingsway, W.C. (5s. net).

The main objects with which the survey has been carried out are three in number: First, to examine the general trade situation in Britain alone, from the standpoint of the electrical manufacturer as well as of the industrialist in other departments who may be in a position to influence the market for electrical equipment; second, to compare industrial progress in Britain with that of the main competitive countries so as to determine the competitive position of our basic industries; and third, to survey, periodically, developments in the prices of essential raw materials used in electrical manufacture, the export prices of finished goods, and labour costs generally, so that a clear conception may be obtained of the force and direction of competition in the electrical industry.

The financial developments that have occurred here and abroad during 1925 and 1926 are first reviewed, and an instructive summary of the effects of the coal crisis on British trade follows. These effects can only be assessed in part at present, but they include an intensification of the search after substitutes for coal or the introduction of new manufacturing processes less directly dependent on coal than hitherto. It is shown that the basis on which the present industrial complex in Britain has been built, namely, an ample and constant provision of coal of high calorific value, must be altered to suit the changing conditions of international competition; the whole problem of industrial organisation and equipment for production has been brought into the foreground, and the formation of trusts and central selling agencies has been hastened; it has been shown that industries depending upon electricity as a main motive force, and deriving their supply from a public utility system, have suffered less than other industries consuming coal direct. Other effects of the dispute have been the necessity for, at least temporarily, higher prices for industrial products, and the weakening of the competitive strength of our main industries overseas. The internal purchasing power of Britain has been reduced and has cut down the margin of capital available for industrial investments. The loss to industry is discussed and, taking everything into account, is estimated in the neighbourhood of £500,000,000. The costs of production have gone up,

and it is regarded as fairly certain that the *régime* of high coal prices will last for at least eight months, the total cost to the consumer of electricity alone being £10,000,000.

Remembering the higher prices of pig-iron and steel products, it is regarded as doubtful whether the most efficient electrical manufacturing firm can escape with an increase in costs less than from 10 to 15 per cent. It is believed that the worst effects of the coal stoppage will be felt in the serious reduction in competitive power of industry, in the loss of markets owing to inability to quote delivery dates, to maintain supplies, or to tender at competitive prices, and in certain other specified directions. Happily, however, there is another side presented by the presence of certain compensating factors.

A chapter on industrial tendencies in Europe contains reference to the expectation that the lull in world trade activity will yield to an intensified demand next year. This view we ventured to express last week in our leading article. It is remarked that the displacement of British exports by exports from other countries is less than might have been expected, and that if manufacturing costs can be kept at their present level, or reduced, the recovery of our overseas trade may be fairly rapid.

Coming next to direct treatment of the electrical industry, it appears that the orders received for generating plant and large industrial motors are now in excess of those obtained during 1925, but there has been a slowing down of electrical development in a number of overseas markets, while at home the possibility of new legislation held up plant extensions and new station work so completely as to make the past year "the most disappointing of all years of depression since 1921." The new plant sanctioned during 1925-26, however, was considerably higher than in the previous year, and has continued at this higher rate with the present prospect that the operation of the new Act in 1927 "should represent a notable increase in orders for generating plant and, above all, for transmission and distribution apparatus." Yet the position at the moment is not altogether promising; indeed, the "outlook would appear gloomy" but for the general stimulative electrical effect of the coal shortage; the possibility of extension of amalgamation and reorganisation measures to various industries, strengthening their financial resources so that they will modernise and extend their equipment; and the *régime* of high fuel prices which may furnish sufficient resources to allow mining concerns to install new equipment.

It is encouraging to read that the possibilities of an intensified demand for electrical machinery from industry later in 1927 are fairly promising. The areas in which there is the greatest electrical activity at the moment are named in the document.

In export electrical trade the situation is satisfactory, and it is anticipated that the value of such exports for the whole of 1926 will constitute a new record at over £18,000,000. Statistics are given showing that in comparison with other competitive countries we have lost ground slightly in electrical machinery and apparatus. The greatest advance has been made by Germany—almost wholly in sales of wireless apparatus, cables, batteries, lamps, and meters; but in heavy electrical machinery, in traction material, and in large industrial motors that country has lost ground. In 1926 British firms are shown to have strengthened their hold on overseas markets in respect of electrical machinery. France and Switzerland have exported a greater tonnage than before, but at greatly reduced prices and a reduction in total value. "The German position is becoming steadily worse. . . German prices are rising in a straight line towards the British." Reasons are given why a considerable improvement in the competitive power of the British electrical industry should take place towards the end of the year, provided that the higher cost of fuel and materials at home do not force British prices upwards. "It may, in fact, be necessary to reduce prices slightly at the present moment to lessen the gap that has taken place between British and German or Swiss prices." Later the statement appears that "The competitive position of Germany, compared with Britain, is worse now than it was a year ago."

The publication proceeds to summarise the position giving a forecast of markets and competitive conditions, and gives explanatory notes of a number of very useful charts.

The foregoing extensive reference to, and quotation from, this first Quarterly Survey of the International Trade situation should impress the reader with our appreciation of its value. A careful study of the document as a whole will bring its full reward to those who desire to have a mind well-informed by authoritative data and views regarding the industry, and the grounds for optimism concerning its future.

Radio Trade Organisation.

We learn that a general meeting of members of the Radio Manufacturers' Association has been convened for Wednesday, December 8th. The Association is now functioning as a properly-constituted body with a steadily increasing membership. The appointments of president, chairman and other officials have been delayed in order that every member may have a voice in these elections. The important matter of exhibitions is included in the Association's programme of activities, and already the New Hall at Olympia has been booked for next year's show, while negotiations are proceeding for securing that building for 1928, 1929, 1930 and 1931.

The Beama Dinner.

The annual dinner of the British Electrical and Allied Manufacturers' Association is one of the largest and most important functions associated with the electrical industry, and usually affords an opportunity for the discussion of some topic of special interest at the moment. This year, of course, the Electricity (Supply) Bill inevitably occupied that position, most of the speeches referring to it more or less directly.

Col. R. K. Morcom, chairman of the Council, opened the "debate" in proposing "The National Development of Electricity Supply," and at once raised a vital issue—as we regard it—namely, the meaning of the word "National." Only by ascribing to it a special meaning, apparently, could he make the toast acceptable to himself or to his audience, and he candidly expressed a preference for the *natural* development of electricity supply, a sentiment with which we sympathise. The eagerness of the politicians to assume the *rôle* of foster-mother to the electrical industry, he hinted, was not requited by the latter, which "might have fared quite well alone." He described the Bill as an emanation from a morass of figures, and his comments on the morality of departing from the firm road of first principles to wallow in a bog of statistics, and on the tendency to rely on "so-called experts," left no doubt as to the odour of the emanation in his nostrils. Neither did his great audience, which represented all branches of the industry, fail to express its appreciation of his views.

We cordially welcome Colonel Morcom's sturdy defence of the electricity supply industry, which, as he said, has done marvellously well in the face of harassing conditions; he put the matter epigrammatically in a nutshell: "We can rely on the supply industry to maintain the voltage if only the Government will reduce the resistance and the consumer will increase the capacity," and his motto: "Look after the demand and the supply will look after itself," aptly summarises the situation. The Government, as Mr. Baldwin foreshadowed last January, has done nothing to stimulate the demand, except to admit the Sale of Fittings clause at the last moment. However, we must be grateful to the Government for a magnificent free advertisement,

if, as Colonel Morcom said, "for no other reason." Fortunately the E.D.A.-E.L.M.A. campaign will go far to remedy that omission, and the probability that its fruits will be placed by the public to the credit of the Government scheme need not trouble us—the main thing is to get the load connected.

Sir Douglas Hogg, in his response, described the Bill as a co-operative measure, to the amusement of his audience, and his assertion that the Government scheme must result in cheapening the cost of electricity was met with cries of "Question." He repeated the argument that high-pressure transmission lines running through villages would supply them with electricity, and claimed that the Bill, when passed into law, would stimulate the use of electricity and relieve us of the stigma of being electrically the worst of the industrial countries; but that charge, and his reference to statistics in support of it, were greeted with cries of "No!"

Only on one point were all the speakers agreed—namely, that the increased use of electrical power in industry was wholly desirable and necessary; and that is a proposition which every electrical man will cordially endorse.

Electricity in Rural Sweden.

THE Institution of Electrical Engineers is to be congratulated on securing for its members so excellent a lecture as that which Dr. A. Ekström delivered before them last week. The author is peculiarly well qualified to deal with this subject, having been the founder of an electricity supply undertaking in Southern Sweden which has grown to very large dimensions, and also being himself an agricultural expert who has employed electric power very extensively in farming operations. But that is not the extent of his qualifications; Dr. Ekström has a command of the English language which enabled him to write with lucidity and aptness of expression, and to address his large audience with a fluency which, combined with personal charm, made his lecture highly enjoyable. His photographs and kinematic films were also exceedingly interesting, and we are glad to know that they are being shown by him before other English societies, and (Mr. R. Borlase Matthews deputising) before the Scottish Centre of the I.E.E. on January 11th.

It is interesting to note that the rapid development of rural electricity supply in Sweden was due to the war, which shortened the supplies of oil fuel and compelled the Swedish farmers to seek another source of power. The only sound alternative was electricity derived from water-power, and the utmost efforts were put forth to provide it quickly; as Dr. Ekström says, many mistakes were made in the early days, and much capital was expended which, in the light of present-day knowledge, could have been saved—but the work was done, and now the Swedish agricultural industry may be regarded as almost fully electrified. Moreover, the author most generously places his experience and that of his fellow-countrymen at the service of this country, in order that we may avoid the errors necessarily incurred by pioneers.

The address, therefore, is most timely and welcome, and our sincere thanks are due to Dr. Ekström for his friendly advice and assistance, of which, we hope, British engineers will avail themselves to the full.

The Volta Centenary Celebrations.

THE electrical industry owes a great deal to Alessandro Volta, Professor in the University of Pavia, who interpreted the phenomena discovered by Galvani 140 years ago, and showed that "galvanic electricity" arose not from the frog's leg with which Galvani experimented, but from the contact of dissimilar metals. Thus he was led to the invention of the "Voltaic pile" with which his name is for ever associated, and of the "crown of cups" which constituted the first electric battery (and which differs only in detail from the primary cell of to-day). His name, enshrined in the word "volt," is constantly on our lips, reminding us, should we pause to think, of the honour which is his due. Not until Faraday made his great discovery of electromagnetic induction was there any practical alternative to the voltaic battery as a source of dynamic electricity.

It is, then, most fitting that our Italian *confrères* should make preparations for the celebration of the first centenary of the death of Volta, with all the éclat appropriate to such an occasion. For this purpose they have formed an Executive Committee, which is organising an international exhibition of electric communications and an exhibition of Italian hydroelectric industries, to be held at Como next year from May to October; exhibitions of Italian silk products, art, and other subjects will also take place. Those who have not already applied for admission as exhibitors in the international section should do so at once, as the last date is given as November 30th. The address of the Exhibition offices is Villa Olmo, Como, Italy.

The Valuation of Street Lighting Service.

THE proceedings at the Conference of the Institution of Public Lighting Engineers, recently summarised in the ELECTRICAL REVIEW, contained an interesting record of progress in several cities. We think, however, there is something in the suggestion made at the meeting that we need a more definite and scientific basis for judging whether real improvements have been made. The difficulty which always meets any public lighting engineer who desires to improve the street lighting and wishes the authorities to permit expenditure with this object is to present the actual details of improvements in a manner they can appreciate—and afterwards to show that this expected improvement has been realised. Street lighting is too commonly assumed to be merely a matter of intensity of illumination. This is doubtless one of the most important matters, as most streets are notoriously underlighted, but there are many other points—freedom from glare, the direction from which the light comes, the distribution of light on the roadway and the surfaces of buildings, uniformity of illumination on the road surface, &c.—which ought to be considered. How much weight is to be attached to these various factors, and how far is it desirable to sacrifice some of these requirements in order to be sure of meeting others?

A typical problem is the reconciliation of freedom from glare and uniformity of illumination. The latter can usually only be obtained by an exceptionally extensive polar curve of light distribution, which is unfavourable to the elimination of glare. There is a tendency on the Continent to hold that the importance of uniform illumination has been over-rated, and that a moderate diversity coefficient may be permitted if, by the use of relatively deep concentrating and opaque reflectors, the filaments of lamps can be completely screened from the eyes of drivers. (It is understood, however, that the change in illumination between lamps must be gradual; sudden contrast and "patchy" illumination are admittedly bad.) The use of such reflectors necessarily leaves the upper parts of buildings in obscurity; some authorities consider this a fatal defect, whilst others think that the illumination of the actual road-surface is of paramount importance. It is thus evident that street lighting is a complex matter. It would serve as a useful guide if authorities could deduce some type of process or formula which weighted correctly the various elements involved.

An attempt in this direction has actually been made in a recent paper by Mr. A. J. Sweet, which was presented at the annual convention of the American Illuminating Engineering Society, and has been reproduced in *The Illuminating Engineer*. The method of making allowance for intensity of illumination on roadway and sidewalk, effects of glare, &c., may not appeal to everyone in its entirety, and the final process of assessing the value of the various items is somewhat formidable. Nevertheless this thoughtful paper deserves careful study.

Colliery Electrification.

A 6,000-kW, 3,300/11,000-V Installation.

By G. S. BOWDEN.

THE electrification of collieries involves some interesting considerations not met with elsewhere.

The example taken for these notes is a large colliery employing 2,500 men and consuming 4,000 kW at peak loads. The winding is done by modified Corliss cross-compund steam engines, and electricity is generated by mixed-pressure steam turbo-alternators, each of 3,000 kW capacity. Various collieries, each of like capacity, are linked by overhead transmission lines operating at 11,000 V.

Extensions to, and considerations of, the plant installed have resulted in an arrangement on rather different lines to that here described, but experience has shown that future extensions on similar plants would be in the direction here put forward.

The choice of generating pressure is decided by the relation between the amount of power generated locally and that used on the site. As the load consisted mostly of large motors (150-1,000 h.p.), 3,300 V would have been a very suitable generating and distributing voltage, giving a minimum of transformer and distribution losses, as the generators were situated in the colliery compressor and winding-engine house.

The choice of main switchgear is the next point to be considered. At the time when the power station was

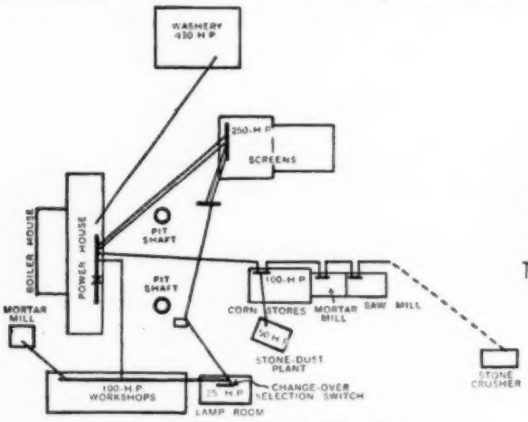


Fig. 1.—Disposition of Colliery Load.

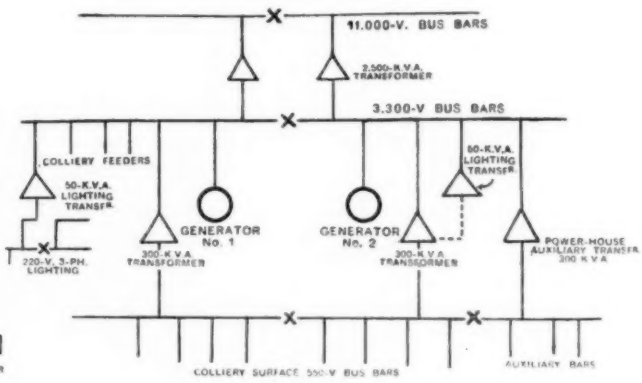


Fig. 2.—Equipment Layout.

laid down, originally, ironclad draw-out or truck-type switchgear had not developed to the extent that it has at the present day. Switchgear maintenance and repairs in most colliery districts are carried out by men who are not of the experienced and capable type which is attracted to the large power stations and other industrial plants. Air in the neighbourhood of a colliery is necessarily dirty and sometimes full of fumes from coke ovens and by-product plant.

Brightwork and bare metal become corroded, and high-voltage switchboards need cleaning every three months.

Provided colliery dust is dry, no great fear need be held for dirty insulators at or below 3,300 V. The writer has found bare terminals at 3,000 V completely enveloped in coal dust upon opening the terminal box of a washery driving motor.

Safety dictates the use of foolproof switchgear, and where cleaning costs have to be kept down, the totally-enclosed ironclad draw-out type is necessary. Switchgear is best placed on the main operating floor in the power house, as when situated in dark basements, leaky steam pipes, passed unnoticed, may result in switchboard faults when moisture condenses on the insulators of cubicle or truck-type switchboards.

On the interconnected power systems of some large private companies the synchronous plant capacity is often sufficient to render a switch dangerous in case of faults, when not up to its duty, and when heavy gear is installed; the throwing of flaming oil, which occurs sometimes under fault conditions, makes the remote mechanical control of switches advisable.

This can be sufficiently provided for by means of a screen of steel panels mounted in front of the ironclad switchgear. The panels form convenient mountings for instruments and relays, and the levers or handwheels controlling the switches would also be mounted thereon.

Duplicate bus-bars are not generally necessary, but division of the bus-bars by a section switch is advisable, care being taken to suitably arrange the feeders controlled therefrom so that the colliery can proceed at a reduced capacity in the event of one half becoming dead.

A colliery power factor is notoriously bad, and ranges from .6 to .8 lagging. Synchronous induction motors are being used as means for increasing the total power factor. This may be very satisfactory where power is transmitted from a distance, but where the generators are of ample rating and the bulk of the power is generated locally, it is doubtful economy to install plant designed for power-factor improvement unless currents in long distributors are reduced.

Oil switches of large breaking capacity cannot be accommodated underground, and the only alternative is to reduce the severity of possible faults. Reactances can be used to attain this end, together with suitably-arranged feeder circuits. Underground ring mains and duplicate feeders are not always possible, but reliability may be improved by taking feeders down different shafts and bringing the cables along different roadways. It is not generally advisable to have several feeders connected to the busbars of one underground sub-station. Each feeder should supply certain motors and, where interconnecting cables are provided, the inter-connectors should only remain closed in time of emergency.

Liquid starters are employed almost universally in connection with underground slip-ring motors, and where used on haulages or as speed regulators adequate water cooling must be provided.

Where chinaware pots are used in such starters, means of circulating the electrolyte must be provided, otherwise it will boil, and cracked pots will ensue. One make of controller on the market dispenses with such pots of chinaware altogether.

On a colliery of this size small motors require on the surface appreciable power, and this may range between 300 and 1,000 kW. As this is generally all at a low voltage, the currents are heavy and the cost of cables appreciable, and some care can be well spent on their arrangement.

The adoption of 440 V for power and 250 V

from the same transformers for lighting is very tempting, but mining regulations and conditions are somewhat severe, and as 250 V for lighting is rather high, 550 V is generally used for power, and the lighting provided from separate transformers.

The coal washery of the Baum type employed but few men, and means for storing unwashed smalls from the screening plant were provided, and as the reliability of a modern electric cable was considered above that of the mechanical apparatus driven, it was decided to be false economy to lay down duplicate feeders. The 3,000-V supply cable was for the major portion of its length exposed to view, and therefore it was easy to locate and repair faults when they occurred.

The estimated loss for a stoppage of, say, five hours on a plant of this nature would not cover the standing charges due to a spare feeder.

This washery was at a distance of some 300 yards from the power station, and was equipped with motors of 200, 150, 50, and 30 h.p. Feeders at 3,300 V and 550 V were therefore necessary, and also two switchboards.

The 50-h.p. motor proved, however, to be too light for its work, and 70 h.p. would have been more suitable. This would have allowed all the motors to be supplied by one feeder, the 200-, 150-, and 70-h.p. motors being wound for 3,300 V, and the small 30-h.p. motor for pumping duty being supplied *via* a 25-kW transformer, 3,300/550 V, arranged with the motor as unit. The cost of the 550-V switchboard and feeders would then have been saved.

The importance of the coal-screening and conveying plant warranted the installation of two feeders, and, from a sub-station in the screens, table motors, tipplers, creepers, lifts, &c., were supplied. The arrangement was such that no one motor, switch, or circuit could hold up the entire output. Main switches were installed to supply each group of motors, which were fed from a link distribution board, of which the cover was interlocked electrically with the main switch.

Regulations and practical considerations call for flameproof and ironclad switchgear for use in screening plants, and should the draw-out pattern be adopted, interchangeability of switches, as has been demonstrated practically, would save much loss of time. Spare switches can be kept ready to replace any l.p. switch on the job; this means only two spares in the majority of cases.

Squirrel-cage motors were employed wherever possible, and with the exception of the picking-table and jigging-screen motor drives, their starting torque was proved to be quite sufficient.

Troubles due to faulty operation of slip-ring gear were frequent, and interlocks were broken by rough handling when not of a most robust nature. Some ingenuity had to be exercised to prevent unauthorised interference with the protective features.

With the advent of a village-lighting scheme in the vicinity, the cost of replacing stolen lamps was considerable. This was corrected by dividing the lighting circuits and installing a small balancing transformer, the lamps being changed from 200 V to 100 V. This was found to be an economically sound proposition.

Fusegear was found to be only suitable for lighting circuits, oil circuit breakers only being able to stand up to the treatment received and give the service required. Owing to one being unable to view all points of conveyors, &c., it was found advisable to ensure the safety of workmen adjusting such apparatus by providing means of locking-off the switches, preventing machinery being started with men working on it. This was arranged in some cases by providing for the easy removal of the switch handles, and in others by the use of padlocks and chains as is usual on boiler steam valves. It was desirable to do this without interference with the electrical isolating features or need of the electrician's attention. Telephone facilities were provided between every section of the colliery and the power house where failure of the motors or power supply was likely to cause costly delay.

The disposition of other loads is shown in the diagram, fig. 1. Of these, the small power required by the charging sets in the electric lamp room was very important, as uncharged lamps would mean idle colliers the next day. By means of a change-over selector switch, power could be taken from either of two feeders. The lay-out of the plant would have been suitable for supply by a ring main. In this case cables between different points would have been necessary to carry the full l.p. colliery load of about 500 or 600 amps. The cable system would then have been much more expensive than that installed when each cable was of moderate size.

Fault location and repair could in most cases be counted on to be performed within four or five hours, and this delay to the other plant shown in fig. 2 was not held to be too great. Also a fair quantity of spare cable was held in stock by reason of the possibility of heavy falls of roof, &c., underground, and whole lengths of cable could be brought into service at short notice where faults in buried cables proved elusive.

Standardisation of motors and control gear is highly desirable in colliery working and means of readily disconnecting faulty switchgear on looped-in circuits such as that feeding the corn store, mortar mill, saw mill, &c.

Overload trips are always best enclosed on colliery surface works, as dust and unauthorised interference tend to prevent their satisfactory working.

Switchgear in a colliery is often exposed to the weather, and where operating mechanism is enclosed in switch tanks, trouble in operating switches may be experienced in severe winter conditions from the high viscosity of the cold switch oil interfering with the normal movement of the operating members.

The writer once experienced a delay in starting the colliery plant of four hours by reason of the latter cause. Every switch tank had to be removed and the oil thawed out before the switch could be closed. The switch oil was of the usual grade and had given previously every satisfaction.

The supply to boiler-house and condenser auxiliaries in the power house will naturally follow standard practice; it is advisable to provide independent supplies for these apart from other colliery circuits, though provision of interconnecting switches will be of value in an emergency.

These can be closed only when required, as the power-plant auxiliary load is more or less constant in comparison with loads mentioned previously, and the equalisation of the loads of the step-down transformers is no advantage and may interfere with power-plant working when exterior faults occur. Central control of l.p. feeders is highly desirable where operation on overload may result in unnecessarily prolonged delays and switches are distributed; where a ring main is employed delays cannot well be avoided.

For lighting, feeders were laid out on the same lines as the power feeders, as in winter time production may be held up for this reason. The lighting system that gave satisfaction above all others was of wire-armoured cable, and watertight fittings supplied by a pioneer firm of conduit makers.

Power and lighting supplies are best taken from the 3,300-V bus-bars, otherwise where the generating pressure of 11,000 V is used, transformation first to 3,300 V and from 3,300 to 550 increases the necessary transformer capacity without need. On several plants this is common practice, as small transformers were not suitable in earlier days for such high voltages as 11,000 V. To-day no fear need be held for such apparatus, and even though the different costs of switchgear for the two alternatives be considered, the advantages of independent supplies are worth while. For instance, when cleaning one switchboard it was inconvenient having to work in darkness. This was a feature of the job where the main generator bars were at 11,000 V, the colliery main board at 3,300 V, and l.p. power and lighting transformers were fed from the 3,300-V switchboard.

An interesting point occurred in connection with a controller of the Weir type. As is well known, these

liquid controllers have of necessity appreciable resistance in circuit when fully immersed, and loss of efficiency and increase in slip are features of this apparatus. The installation of contactor gear to fully short-circuit the rotor of a large mine hoist resulted in reduction of slip and corresponding increase in efficiency to the extent of 3 per cent.

The maintenance costs of oil-break reversing switches of main hoists led to the introduction of contactor reversing gear, and this, operating at 600 amp. and 3,300 V, was a sight worth seeing. Maintenance of oil-break reversing switches underground on busy haulages made switch inspection necessary twice weekly.

Extra-High-Pressure Aerial Lines.

Some Useful Accessories Facilitating Erection.

By THEODORE RICH.

AT the present moment on the Continent a considerable number of installations are at work, or under construction, on pressures of 50,000 V and upwards for which aerial lines are used; it is at about this voltage that the question of pin *versus* suspension insulators becomes important.

As a rule in the past, designers and makers of various

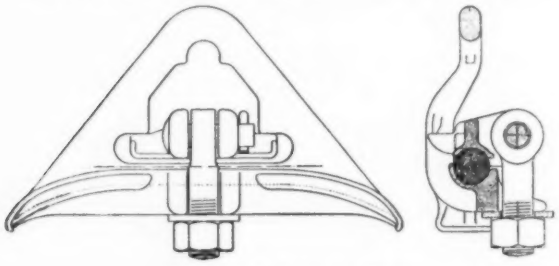


Fig. 1.—Plain Suspension Grip.

accessories used on what might rightly be termed "extra-high-pressure" aerial lines, have considered the strictly electrical and mechanical stress factors affecting the various classes of supports, insulators, &c. In some directions the mechanical questions have given rise to

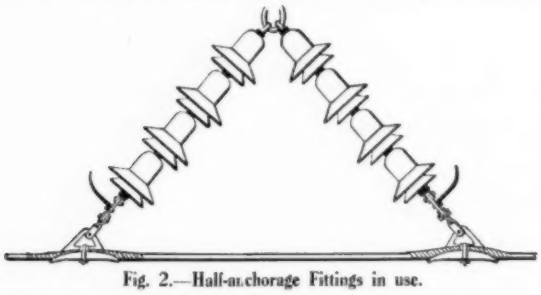


Fig. 2.—Half-anchorage Fittings in use.

more trouble than those of a purely electrical character, although the electrical stress sometimes gives the final blow at a point where some form of mechanical weakness has developed.

At times considerable difficulties have been met with

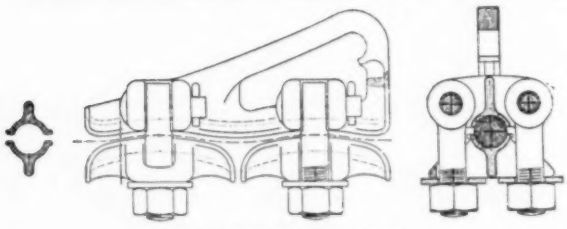


Fig. 3.– Half-anchorage Grip-unit.

regarding the fixing and cementing of pins into insulators, the cementing together of multipart multi-petticoat insulators, and the correct methods of securing the conductors to grooves in the top or on the sides of the insulators. Too often the factors of convenience and general handiness, as affecting construction and repairs, have been kept in the background. Skilled labour has almost everywhere gone up in cost very much, and it is important that accessories should not merely be secure when put into place, but they should be, as far as possible, of such a form that they can be rapidly fixed with a minimum of time and tools. Power lines do not usually go along the middle of asphalted roads, and if a man who is, so to speak, hanging "by his eyelashes" on to a bracket on a steel lattice tower 40 or 50 feet high, drops a nut or some small part,

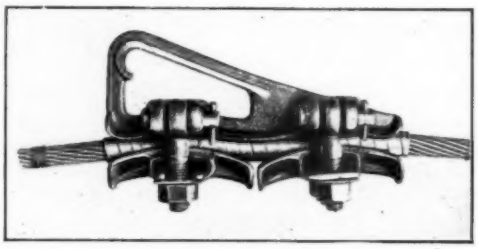


Fig. 4.—Cable Clamped.

it may cause bother, delay, or loss of material in long grass or in some other place where it cannot easily be "spotted."

It becomes important, therefore, not merely for erection in the first place, but also in cases of repair, where every minute may mean a lot of money, that where aerial accessories are concerned handiness should be studied and the number of loose parts which are liable to fall reduced to a minimum.

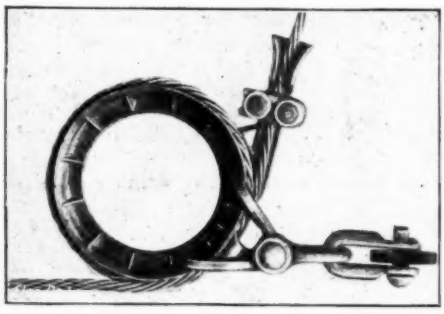


Fig. 5.—Capstan-Grip Anchor.

In France the Government, in order to assist the home industries and to minimise the effect of purchases of foreign raw copper under the existing exchange ratios, has encouraged the use of aluminium steel conductors for aerial lines. The use of compound conductors under high tensile stress has at times given rise to some mechanical difficulties, and care has to be taken to prevent injury at points of tension and suspension. There is also the consideration that to reduce any tendency towards crystallisation, the weight of accessories

attached to a conductor and suspended with it should be reduced to a minimum.

In view of the requirements of aluminium steel lines, Monsieur Dessangey, engineer of the Société pour Les Applications de l'Aluminium et des Alliages Légers (Light Alloys), of Grenoble, has designed and patented a number of accessories which show in their design and application a considerable amount of ingenuity. They are intended for copper as well as aluminium lines. A number of these were on view at the Exhibition at Grenoble last year.

In the Dessangey designs, in order to reduce the number of loose parts, hinged bolts have been largely made use of; by this means a conductor can be enclosed within hinged grips which are rapidly screwed up by tightening the nuts already in place on the bolts.

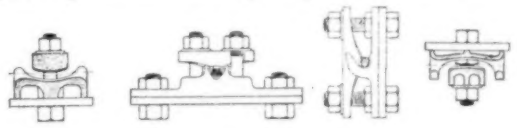


Fig. 6.—Earth Wire Clip.

There are three classes of grips in general use on chain-insulator lines—the plain suspension, the half anchorage, and the full anchorage.

In order to protect the cable, the makers recommend that a flat strip of aluminium should be wound round the stranded conductor where the grips hold. Fig. 1 shows a suspension of the normal type; with a slight modification it can be fitted with "horns." The conductor is lifted into the groove, like a sling into a hook, where it will hang safely for the time being. A grip piece, with two locking fingers, is slipped over the cable, the hinged bolt with a slackened back nut is pushed into the recess arranged, and by screwing up the nut the grips are tightened up with the aid of the leverage centred on the tips of the fingers. Only one nut is required for the complete gripping of the conductor, and two or three turns are enough. It would be difficult to imagine anything simpler.

Fig. 2 shows one use for a half anchorage, and figs. 3 and 4 show the detail. There is one main top casting, from which are loosely suspended two bottom grips, one

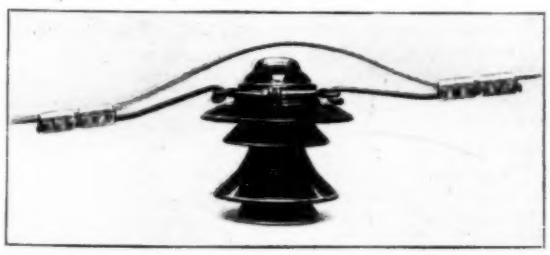


Fig. 8.—Pin-insulator Clamp.

permanently hung by a hinged bolt on the right-hand side and the other hung on the left. When the conductor is put into position, each grip is swung round like a hinged link, and two further hinged bolts are put into their open-sided seats, and the nuts are then screwed up, the arrangement being analogous to the fingers and thumb gripping a rope. There are no loose parts, the top casting, two grips, and four bolts, with washers, being hoisted into position linked together.

A Capstan-Grip Anchor.

Fig. 5 shows a capstan-grip anchor casting. The cable is turned round the ring once and fastened with a link clamp; owing to the clinging action, the frictional surface for gripping is very great, and the pull on the clamp is small. This type has been tested; with but one clamp it will stand a pull equal to that which a cable itself will stand without damage; with this type of anchorage no binding strip is necessary. It is claimed that the weight is less than half that of many anchor clamps on the market. These accessories are usually made of malleable iron galvanised.

Fig. 6 shows a type of clip for the rapid attachment of an earth wire; it is made in horizontal and vertical patterns; in the former the movable jaw of the clamp is made like a latch. These can be secured to the towers or other supports before erection. Fig. 7 shows a tool for making joints on aluminium cables; the two cable ends are slipped through an oval aperture and twisted, the double-handed grips being light and handy. Fig. 8 shows the pin-insulator clamp made by the same com-

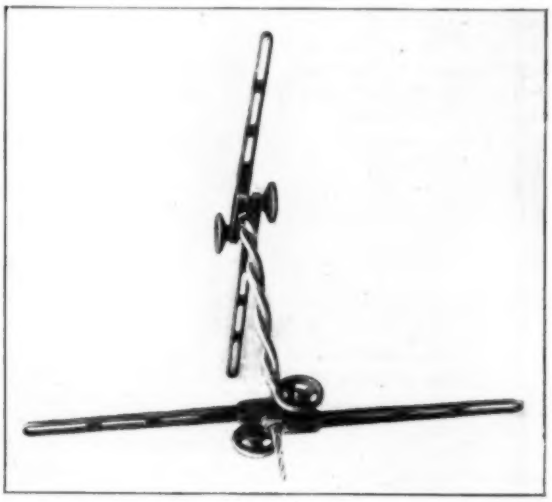


Fig. 7.—Twist-jointing Tool.

pany. Fig. 9 shows a method of binding for aluminium cables on pin insulators. A flat strip is first wound round the conductor to protect it, and then a strip nearly semi-circular in section is used with the rounded part against the insulator channel. The illustration depicts its application to a glass insulator.

It may be noted here that large numbers of high-pressure glass insulators, especially those of the pin type, are used in France; they are much cheaper than

Fig. 9.—Pin-insulator Binding.

porcelain, and some power companies find that near the seashore, where a combination of salt spray and fog is met with, they are preferable to porcelain. Some other authorities say they are not so reliable as porcelain. Quite a large trade has grown up near Rheims, based on experience in glass manufacture, in connection with bottle-making.

Radio Research in Australia.—At a conference of the Federal Wireless Institute of Australia at Sydney, Prof. Madsen, professor of electrical engineering at the University of Sydney, emphasised the need for the appointment of a board of wireless research, similar to that which was created in Great Britain in 1920. The conference endorsed the proposal, and it was also unanimously decided that the Institute should appoint three delegates to the world Conference at Canberra at the opening of the Federal Parliament next year.—*Reuter's Trade Service* (Melbourne).

Electricity Supply in Great Britain.—XVIII.

SCOTLAND.

THE 1921 Census population of Scotland was 4,882,497 persons, for an area of 29,796.4 square miles, thus giving an average density of 164 persons per square mile.

The country is divided into 33 counties, 22 of which have densities of less than the total average.

The other eleven counties and their population densities are given below:—

County.	Average density of persons per square mile.
Lanark	1,745
Midlothian	1,383
Renfrew	1,263
West Lothian	699
Dumbarton	615
Clackmannan	596
Fife	580
Stirling	358
Forfar	310
Ayr	264
East Lothian	178

The above eleven counties, although only comprising 17.2 per cent. of the total area of Scotland, contain 75.4 per cent. of the total population. It will be found that these counties are almost entirely covered by statutory powers for the supply of electricity, whilst the only large undertaking in the remaining twenty-two counties is that of Aberdeen Corporation.

A complete list of all authorised undertakers in Scotland holding statutory powers for the supply of electricity at December 31st, 1923, together with the salient administrative particulars of each authorised undertaking, is given in the Electricity Commissioners' publication of administrative particulars (Local Authority Undertakers, pages 108 to 119 inclusive; Company Undertakers, pages 292 to 319 inclusive).

Since December 31st, 1923, the following Electricity Special Orders and Electricity (Extension) Special Orders (in respect of authorised undertakers in Scotland) have been approved by Parliament:—

Ayrshire Electricity Special Order, 1924.
Bridge of Allan E.S.O., 1925.
Busby Mearns and District E.S.O., 1924.
Cambuslang E. (Extension) S.O., 1924.
Crieff E.S.O., 1925.
Dumbartonshire E.S.O., 1926.
Eastwood and Cathcart E. (Extension) S.O., 1923.
Greenock E. (Extension) S.O., 1925.
Helensburgh E.S.O., 1925.
Holytown, Carfin and Cleland E.S.O., 1923.
Inverness E.S.O., 1926.
Lanarkshire (Western Area) E.S.O., 1923.
Linlithgow and Falkirk District E. (Extension, &c.) S.O., 1926.
Lothians E.S.O., 1924.
North Berwick E.S.O., 1925.
Overtown and Law E.S.O., 1923.
Renfrewshire (Western Area) E.S.O., 1925.
Tobermory E.S.O., 1926.

The following is a list of the existing authorised undertakers:—

Local Authorities.

Ayrshire Electricity Board.
Dumbartonshire County Council.
Lanarkshire County Council.
West Lothian County Council.
Aberdeen Corporation.
Alloa Corporation.
Borrowstounness Corporation.
Bridge of Allan Corporation.
Dalkeith Corporation.
Denny and Dunipace Corporation.
Dumbarton Corporation.
Dumfries Corporation.
Dundee Corporation.
Edinburgh Corporation.
Falkirk Corporation.
Glasgow Corporation.
Greenock Corporation.
Hamilton Corporation.
Helensburgh Corporation.
Invergordon Corporation.
Inverness Corporation.
Kirkcaldy Corporation.
Kirkwall Corporation.
Lossiemouth Corporation.
Motherwell and Wishaw Corporation.
North Berwick Corporation.
Oban Corporation.
Paisley Corporation.
Perth Corporation.
Rothesay Corporation.
Stirling Corporation.
Tobermory Corporation.

Companies.*

Arbroath Electric Light & Power Co., Ltd.
Clyde Valley Electrical Power Company.
Coatbridge and Airdrie Electric Supply Co., Ltd.
Crieff Electric Supply Co., Ltd.
Dunblane & District Electricity Supply Co., Ltd.
Duncan's Electricity Supply Co., Ltd.
Electric Supply Corporation, Ltd.
Elgin Electricity Supply Co., Ltd.
Ericht Water and Electric Power Company.
Fife Electric Power Company.
Fife Tramway, Light & Power Co., Ltd.
Galashiels & District Electric Supply Co., Ltd.
Grampian Electricity Supply Company.
Kilmalcolm Electric Lighting Co., Ltd.
Lanarkshire Hydro-Electric Power Company.
Lochaber Power Company.
Loch Leven Electricity Supply Co., Ltd.
Lothians Electric Power Company.
Musselburgh & District Electric Light & Traction Co., Ltd.
North of Scotland Electric Light & Power Co., Ltd.
Richmond, Gordon and Lennox, Duke of, K.G.
Scottish Central Electric Power Company
Scottish Midlands Electricity Supply, Ltd.
Skelmorlie Electric Supply Co., Ltd.
Strathclyde Electricity Supply Co., Ltd.
Urban Electric Supply Co., Ltd.

*Including authorised persons.

Applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, have been lodged by the following:—

Strathpeffer and Dingwall Electric Co., Ltd.
Electric Supply Corporation, Ltd.
Dornoch Corporation.
Wick Corporation.
Fife Tramway, Light & Power Co., Ltd. (Extension).
Galashiels & District Electric Supply Co., Ltd. (Extension).

The number of kWh generated in Scotland, as given in the Electricity Commissioners' annual publication, "Generation of Electricity in Great Britain," is as follows:—

Year ending 31st March	kWh generated.
1922	546,201,597
1923	595,177,145
1924	701,101,195
1925	775,116,417

In preparing this, the last of our series of articles on "Electricity Supply in Great Britain," we were surprised to find how much useful work had been done to help forward the development of electricity supply in Scotland. Powers have been obtained for several important hydro-electric developments—the Lochaber scheme, estimated to give over 70,000 h.p., at Fort William; the Grampian scheme, to give 56,000 h.p.; the Loch Doon scheme of 1,010 h.p.; and the Falls of Clyde scheme, giving from 6,500 to 13,000 kW, according to the time of the year.

As regards Electricity Districts, the Edinburgh and Lothians Electricity District has been approved by Parliament, and we understand that the Edinburgh Corporation and the Lothian Power Company are now carrying out many developments. In the case of the West of Scotland Electricity District, after a long inquiry lasting several days, the Electricity Commissioners decided to defer issuing any pronouncement

upon the scheme submitted, pending possible changes in the circumstances due to the Government proposals.

A detailed investigation of the cost of unifying frequency in the Clyde area was carried out for the Electricity Commissioners in 1924 by Messrs. Merz and McLellan, at a cost of £4,206.

The Lanarkshire Hydro-Electric Power Co. was incorporated by Act of Parliament in 1924, to establish the Falls of Clyde hydro-electric works (referred to above) in the county of Lanark and to supply electricity to the Clyde Valley Electric Power Co. and other authorised distributors; the latter company also obtained powers in the same year to increase its capital and extend its area.

The Complete Salesman.

By "Our Mr. SMITH."

AN advertisement once appeared in the treasured centre pages of this journal embodying the words: "Should possess the essential qualifications of a salesman." The qualifications were not enumerated, it being assumed that they are known to all who aspire to positions of the type covered by the advertisement.

What are the essential qualifications of a salesman? Ability to sell, the unthinking may answer. True, but rather like answering the question, "How does one become rich?" with the words, "By making money." The writer readily admits that abler pens than his have shed light on the character, life, and habits of the genus salesman, but unfortunately the said pens have dealt with the matter in such a scientific and abstract manner that much of the wisdom has been lost to ordinary second-class brains. It may be of interest to budding salesmen, even, perhaps, to full-blown specimens, to deal with this important subject in a manner easy of comprehension by the *hoi polloi* (which means, roughly, Tom, Dick and Harry).

Most salesmen are paid a small retaining fee and a violently fluctuating bonus which bears some ridiculous proportion to the value of the sales made. This being so, the most important qualification during the present depression is, surely, a private income. If it is so private that the Income Tax people are not aware of its existence, so much the better, but even a public private income is better than the kind of emolument which never seems to get off the zero mark. In passing, the derivation of "emolument" may be considered. The word comes from "emolumentum," a working out, and "molior," to exert one's self. The word might have been made for salesmen; working out (in the rain understood) and exerting one's self.

The second qualification depends on whether the salesman uses a car or moves with the aid of public conveyances. In the former case he should be able to change a wheel without losing that well-groomed appearance so necessary to his calling; should have an intimate knowledge of every street in every town in his area; and should have a highly developed flair for finding parking places. The last item is rather important; it is so annoying to leave the car in a quiet spot, find a restaurant, and be about to toy with a cutlet, when the policeman appears and demands the instant removal of the car.

The traveller by public conveyances must carry Bradshaw in his brain, together with a complete list of the 'bus services in his area. A knowledge of any cheap travel facilities available is also useful. A steady hand is essential; it is sometimes necessary to write legibly in a train or to work out simple calculations in the blank space, headed "Stop press," left for the purpose in newspapers. (Not "for them as can't read," as has been suggested.) Camel-like, the train traveller must imbibe sufficient nourishment in the morning to carry him through the day. As there is a limit to the facilities afforded by train, tram and 'bus, sound feet are handy, and if a bag has to be carried, a strong right arm also is not wasted.

Ranking almost equal in importance with the qualifications already considered is the gift of selection in the matter of hotels. Salesmen always say, airily, "Oh! I always stop at the Blitz," but this is said merely for effect; actually they know of a much more comfortable place where the charges are lower and the food more satisfying, though how they find these places must ever remain a mystery to the uninitiated.

Of course, a salesman does have to meet an occasional customer or "prospect." The method of approach is important. An accomplished representative will be able to talk of anything from abiogeny to zymology, but the knowledge of the name of a likely trier for the two-thirty is a wonderful stand-by for the less learned. Beware, however, of giving the name with too much confidence, unless a return visit is unlikely. A friend of the writer once made his name in this manner, but as he is an Inspector of Factories, and can demand entry into any workshop within the meaning of the Act, his lucky shot was quite wasted.

Beware the stereotyped opening gambit, such as "Good morning, Mr. Green. I hope you are well." Strike an original note, something like: "Good morning, Mr. Green. You will excuse me saying so, I hope, but you are looking a little overworked." That will start off Mr. Green; he will plunge into an account of his many woes, and by the time he has finished will feel he has known you for years. This is not always effective with men who pride themselves that they thrive on hard work and feel ten years younger than they are, but such men can usually be detected by their iron jaws.

Personal appearance counts, but not always for what one might fondly hope.

There are many minor qualifications, such as love of travel, ability to shave neatly and painlessly in a hotel bedroom, great economy in personal expenditure, and an absence of worry as to where one will be at sixty.

It is perhaps as well to know all that can be known about the plant one wishes to sell. One should be able to give advice when necessary, and to know when it is necessary and how to give it without also giving offence. A real salesman is born with the gift for obtaining interviews in the face of notices to the effect that "travellers" will only be seen by appointment.

But do not forget the private income.

Large Electric Winder for New South Wales.—The Metropolitan-Vickers Electrical Co., Ltd., has received an order from Caledonian Collieries, Ltd., New South Wales, for a large electric winder with Ward-Leonard control for installation at the Aberdare Central Colliery. The set is required to wind a net load of 7½ tons of coal from a depth of 1,260 ft. at the rate of 490 tons per hour. The winder will be driven by two direct-current motors having a combined capacity of 4,500 h.p. (r.m.s.) and capable of dealing with a peak load of 11,250 h.p. The motors will operate at 57 r.p.m., and will be directly coupled to a cylindrical drum of 14 ft. diameter. The equipment will be so designed that an output of two-thirds the normal can be obtained with only one of the driving motors operating. Direct current for the winding motors will be supplied by a flywheel motor-generator set consisting of a 1,500-h.p. induction motor driving two generators, each of 925 kilowatts capacity, with an overhung exciter and a 12½-ton flywheel. The energy stored by the flywheel will be sufficient to complete a wind under full load should the electricity supply fail at any stage of the wind after completion of the accelerating period. The flywheel will be coupled to the set by a Vickers radial star clutch, by means of which it can be released when not required as, for instance, when the set is being used for winding light loads outside the hours of normal output. A Lilly overspeed and overwind protective device is to be fitted on the equipment. The mechanical parts of the winder will be supplied by Messrs. Fullerton, Hodgart & Barclay. While the equipment will not be by any means so large as some other electric winding plant now being manufactured at the Trafford Park works of the Metropolitan-Vickers Electrical Company, the winder motors will be of considerable size. Their overall diameter will be 13 ft. 4 in. and their base 15 ft. 6 in.; the armature diameter will be 9 ft., and the total weight of each machine 68 tons, of which the armature will weigh 29 tons. The motors will be similar, as regards weight and dimensions, to machines installed by the Metropolitan-Vickers Company for the Rand mines and the Chinese Engineering Company, and to the motors of an equipment now being completed for the Carlton Main Colliery Company, which, when installed, will be the largest electric winder in this country.

Lightning Discharges.

The Protection of Radio Aerials and Apparatus.

By T. C. GILBERT.

THE question of protecting aerials from lightning is suggested by the remarks one often hears about the danger of aerials being struck, and both themselves and valuable apparatus being damaged or destroyed; in fact, one of the first questions asked when the erection of aerials is being considered is: "What is the risk from lightning?"

The easy way in which one is told simply to earth one's aerial, or that a home with an earthed aerial is safer than one without any aerial at all, convinces the writer that serious thought has not been given to the problem, and it is, therefore, the purpose of this short article to deal with the conditions to be met.

Perhaps the best way to approach the subject is to consider the general principles underlying the protection of buildings from lightning, which will mean a short study of the theory of lightning conductors.

A thunder cloud, as is well known, is simply a mass of vapour which has, by evaporation or friction of air currents, become charged with electricity at a potential differing considerably from that of adjacent clouds, or of the earth beneath it. Charges of electricity of opposite polarity are drawn by induction to the surfaces of adjacent clouds, or the earth, nearest to the thunder cloud, and these again react upon the thunder cloud, so that a huge electrical condenser is formed.

Should the difference of electrical pressure between the oppositely electrified cloud and earth (which is all we need consider at the moment) become sufficiently great, an electric discharge of a disruptive nature will take place across the air space separating the cloud and earth, due to Nature's effort to neutralise the two charges. The cloud and earth being imperfect conductors, it is possible that the whole of the charges will not be parted with at once, but that further discharges will take place until the electrical pressure between the cloud and earth is insufficient to bridge the intervening air space. Damage to buildings, &c., may be caused by the violently disruptive nature of the discharge, or from its heating effect.

The determination of the path that a lightning discharge will take depends in a complicated manner upon several factors, and it is necessary to consider not only the electrical conductivity of the materials in that path, but also their shape. It may be assumed, however, that good conductors will offer less impedance to the lightning discharge than inferior conductors, and these good conductors, led as straight as possible, will form a path of least possible impedance between any two points.

It is also probable that the lightning discharge will divide between several paths rather than follow a single path; naturally the greater part of it will pass by those paths whose impedance is small. Should, however, the impedance of some of the possible paths of the lightning discharge be infinitely great compared with the remainder, it will be found that practically *none* of the lightning discharge will pass by these paths, but it will pass entirely over those of low impedance.

For instance, if two lightning conductors were erected side by side, made of the same material, connected to the same earth, and of the same height, and one were bent into several loops, it is practically certain that it would never function as a lightning conductor, and that the whole of the possible discharges would be taken by the straight conductor. If, however, the good straight conductor were removed, leaving the bent one as the only possible path to earth for a lightning discharge, even then the discharge would not pass round the loops, but would bridge the air gaps between the nearest portions of the conductor, disruptive discharges taking place at each of the bends.

It will be seen at this stage that a discharge striking an aerial could not pass to earth *via* the tuning inductance, owing to the very high impedance of the latter, even if only of few turns. It would probably, in the absence of any protective gear, prefer to bridge the aerial and earth terminals, or the parallel condenser, and result in the destruction of the inductance and condenser at least.

Very complicated secondary actions immediately follow a lightning discharge, similar to the discharge of a condenser or Leyden jar, and these cause great practical difficulty in ensuring good protection for buildings, &c., as the conditions necessary for protection from the secondary discharges are antagonistic to those necessary for protection from the primary discharge. For instance, good protection can be afforded from these secondary discharges by increasing the impedance of the path provided, but this is fatal for protection from the primary discharge. The rules usually followed for the protection of buildings from lightning, however, have proved reasonably satisfactory, inasmuch as they were designed for protection from the primary discharge in the main, and a consideration of the two-fold function of a lightning conductor will assist us in determining the best way to protect our aerial.

The average conductivity of the earth is fairly good, with the exception of sandy deserts or chalk downs. The risk of lightning in these districts is small, as the induced charge cannot be drawn to the surface so easily.

The most likely objects to be struck by a lightning discharge are those which project above the general level, as of whatever material they are composed, it is almost certain that the impedance offered by them will be less than an alternative path through air. Factory chimneys are very liable to be struck, not only for the reason given above, but also because columns of rising smoke or steam are of a higher conductivity than cool air. Also moist air will conduct a lightning discharge more readily than dry air, which is practically a non-conductor.

A lightning conductor is usually a pointed metal rod fixed on to any salient point of a structure, in intimate connection with the earth, the main function of which is to carry the lightning discharge harmlessly to earth by offering a path of low impedance. It fulfils another function, however, by tending to *prevent* a disruptive discharge by means of the phenomenon known as "brush discharge," which it carries out in the following manner.

A thunder cloud approaching a structure will draw, by induction, a charge of electricity of opposite kind to the surface of the earth in the vicinity of the structure. If a sufficient number of sharp points have been provided by the lightning conductor or conductors on that structure, and if they are all in good connection with the earth, the induced charge will be dissipated as fast as it is formed. This tendency of points to dissipate a charge is well known, and the idea is to foster this brush discharge, as it is called, by providing as many sharp points as possible on the lightning conductors. The discharge is usually silent, but if very rapid may not only be audible, but visible. Also the flow of electricity from the points is directed towards the charged cloud, and this will probably neutralise some of the inducing charge, tending to restore the cloud to a more normal state, this to some extent reducing the risk of a disruptive discharge.

It will at once become apparent to the reader that an aerial, if earthed, can as easily carry out this protective action as a lightning conductor. Even a single-wire aerial, if stranded, can be assumed to possess seven sharp points, and a multi-wire aerial correspondingly more. For it to carry out this function, however, it is essential that it be earthed, or normally connected to the receiver.

Now this action is only protective in the case of a lightning conductor and not in the case of an aerial, for the following reasons. If the brush discharge has not been sufficiently rapid, a disruptive lightning discharge

takes place. The path for this disruptive discharge has been prepared for it by the previous brush discharge, and, in the case of the lightning conductor, no damage is done, as the discharge is carried off harmlessly to earth. It may thus be said that, by virtue of this brush discharge, a lightning conductor actually *attracts* lightning, and there is no doubt whatever but that an earthed aerial will do the same thing.

Will it, however, fulfil the second function of the lightning conductor, and carry off the disruptive discharge to earth? That we will now proceed to investigate.

It has been found that if lightning rods are designed with a very sharp point to facilitate the brush discharge this point is invariably fused by the first discharge that falls upon it. Attempts have been made to obtain infusible points by the use of platinum and silver alloys, but all that has been achieved has been to enormously increase the cost. The tendency now is to provide a lightning conductor with a prolonged upper terminal with a blunt point, designed to receive the disruptive discharge, and to place several sharp points projecting upward at some distance from the top of the conductor, with a view to facilitating the brush discharge. This arrangement has proved reasonably satisfactory, although the writer has seen an iron spike, in use as a lightning rod, of square section with sides of about $1\frac{1}{4}$ in., fused up into a rough ball for about six inches of its length. The rod was erected for the protection of an oil tank, and the discharge which fell upon it did not appear to be of extraordinary violence.

It would appear from the foregoing that quite considerable currents are to be expected. An American, Dr. Steinmetz, has calculated that even in ordinary lightning flashes the enormous pressure of 50,0000,000 volts may be met with, and the currents may in some cases rise to 5,000,000 amperes.

The Lightning Rod Conference of 1881 recommended the following minimum sizes to be employed as conductors, from the lightning rod to earth:—

Material.	Section.	Area, sq. in.
Copper tape	$\frac{3}{4}$ in. × $\frac{3}{4}$ in.	0.09
Copper rope	$\frac{1}{2}$ in. dia.	0.10
Copper rod	$\frac{3}{8}$ in. dia.	0.11
Iron rod	$\frac{9}{16}$ in. dia.	0.25

It will thus be seen that an aerial cannot under any circumstances be expected to deal with a direct disruptive discharge, unless that discharge is exceedingly small. The writer is here speaking of amateur aerials, of course, as possibly the aerials of broadcasting or commercial stations may be in excess of the above dimensions. A single-wire aerial of 7/22 cable has an area of only .0045 sq. in., and even a multi-wire aerial can usually only be assumed to be of the same size, as a single wire is often employed as a lead-in. It is practically certain that a lightning discharge falling upon an ordinary aerial would immediately destroy it, and the discharge would then seek an alternative path to earth through the building.

It is, therefore, the considered opinion of the writer, in direct contradiction to the generally accepted view, that earthing an aerial is the best way to place it in danger. To protect it, leave it, when not in use, completely insulated and entirely disconnected from earth. The free end may be placed outside the building, but in any case should be disconnected from the receiving set. A gap should be arranged between aerial and earth, preferably mounted outside the building to prevent impedance. If mounted outside, however, it must be of special design, or trouble will be experienced with leakage in wet weather. Something similar to the G.P.O. lightning arrester would be suitable, if covered.

In the generally accepted method, the aerial is earthed by means of a switch which simultaneously disconnects the receiving set. This will allow the aerial to perform the (what is called) *preventive* action in the case of a lightning conductor, and in so doing tend to draw the disruptive discharge upon itself, which it cannot possibly cope with. In effect, it amounts to taking the induced charge in the earth nearer the charged cloud than it would otherwise be, by a distance corresponding to the height of the aerial, and saying to the thundercloud: "Here is your opposite charge, come and neutralise it quickly"—which is, of course, exactly what it is striving to do.

The only possible advantage the writer can see in this arrangement of an earthed aerial is that it enables an aerial to dissipate to earth any accumulation of static electricity from the atmosphere, which in certain circumstances may be considerable, even without the presence of lightning. Also, unless the earthing switch is mounted outside the building, the wires leading to it usually offer a path of high impedance to a lightning discharge, and the chances are that even if the aerial were of sufficient section to deal with it, the discharge would leave the wires in search of a path of less impedance before reaching the switch. If the earthing switch is placed outside the building, trouble is again experienced with leakage from the aerial, unless the switch is of special design.

It may be stated here in connection with the writer's recommendation to leave the aerial entirely insulated, that an earthing switch may be employed as well, but left *open*. Before placing the aerial into use again, it could be momentarily earthed, thus freeing it of any accumulated static charge.

There is, however, another serious reason why an aerial should not be expected to deal with a lightning discharge, and that is that the earth and other connections are not generally sufficiently good. In this we may again consider the requirements of the lightning rod as regards earthing, which are somewhat stringent.

If the earthing of a lightning conductor is not good, which condition may be caused by defective joints, for instance, although it may to a certain extent protect a building by determining the path of the discharge, yet it is regarded as a positive danger. For example, the disruptive discharge would probably shatter the defective joint and seek an alternative path through the building. For complete protection, a lightning rod must have the best possible earth connection that the nature of the soil will permit, and the electrical resistance must be less than that offered by any alternative conductors in the path of likely discharges, such as gas or water pipes outside a building, which are, be it remembered, well connected to earth.

Unless the surface soil is permanently moist, earth plates must be provided both at deep and shallow levels. This is for the reason that, after spells of hot, dry weather, the induced charge will not be found at the surface of the earth but probably at some damp substratum; but after rain, and this will most likely occur during the thunderstorm, the induced charge will probably appear on the surface; hence the necessity for both deep and shallow earths.

These earth plates are usually made as large as possible and buried in small coke or charcoal, both fairly good conductors of electricity, but—what is more important—able to absorb and retain moisture.

How many amateurs, or for that matter, professionals, can boast of an earth connection that will fulfil these conditions? Is it not more often of the buried-bath or biscuit-tin order, or a turn or two round and soldered to the nearest gas or water pipe?

It is, then, apparently impossible to protect our aerials from lightning. Luckily, thunderstorms are comparatively rare in this country, and direct lightning discharges, especially in towns, are rarer still.

We will assume that the lightning risk is extremely small, but the writer's point is— do not add to that very small risk by earthing your aerial. On the approach of a thunderstorm, disconnect your aerial and forget it; don't attempt to protect it at all. In view of the title of this article, this rather places the writer in the position of the old Burgomaster who gave a visiting king one hundred reasons why they had not fired a salute on his arrival. The one-hundredth reason was: "Because, sire, we have no cannon."

The whole subject is, however, generally but little understood, and a study of the conditions to be contended with will be well repaid.

Rendering Machinery Sound-proof.

A New Sub-station of the Hull Electricity Undertaking.

IT frequently happens that a selected site for an electric sub-station is suitable only from the point of view of its convenience for distribution purposes, and often is entirely unsuitable with regard to the immediate surroundings, particularly if it is in a residential area. The noise emitted by rotary converters and transformers is usually of a peculiarly insistent and irritating character and a great nuisance to residents living in the neighbourhood of the sub-station, and it may possibly result in litigation.

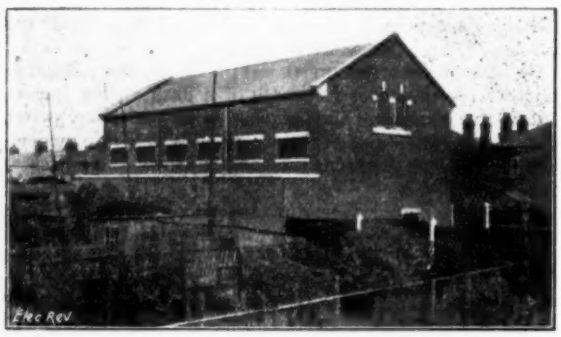


Fig. 1.—Sound-proof Sub-station at Hull.

From this point of view a sub-station which has recently been completed for the Hull Corporation electricity undertaking is of particular interest. It houses at present two rotary convertors, and no sound is audible or vibration perceptible outside of the building. The site chosen is in the heart of a residential area and is about 50 ft. distant from the nearest houses. It was realised that the noise from 2,000 kW of rotary convertors would probably disturb the surrounding residents, and it was decided to construct a special sound- and vibration-proof station.

Both externally and internally the building, fig. 1, appears to the casual observer as an ordinary type of sub-station, and does not suggest anything unusual. The principal features lie in the construction of the foundations for the rotary convertors, and the walls and doors of the building.

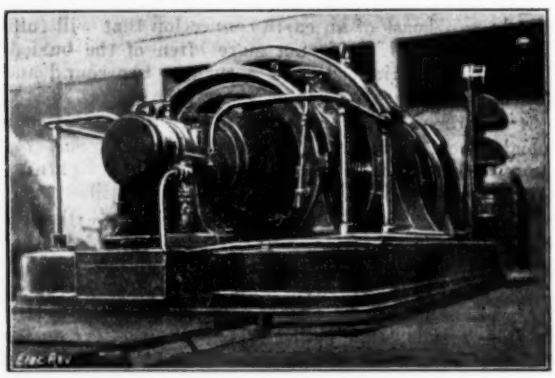


Fig. 2.—Machine on Isolating Medium.

Working on the principle that all the mechanical vibration and a large proportion of the sound is transmitted through the foundations supporting the machinery, the sets were erected upon "Coresil" cork foundation plates, fig. 2—a very efficient, it is claimed, sound- and vibration-isolating medium—thus preventing transmission from the machines. The transmission of the primary air vibration or sound directly through the air from the machines to the outside is prevented by the main walls, ceiling, windows, and doors being specially constructed so as to retain the sound within the building itself.

A difficult problem to solve was that of filtering the sound out of the ventilating air; about 20,000 cu. ft. of air per minute passes through the machines and out of the building. This was overcome by passing the air through two registers in the ceiling, and then through sound filters constructed in the roof space. The soundless air is then discharegd into the space between the ceiling and roof and finally into the open through an outlet provided especially for that purpose. With the exception of these exits, the building is airtight.

The main door, 10 ft. by 12 ft. 6 in., is of sound-proof construction in a close-fitting framework to ensure air tightness, and the smaller doors and windows are also constructed upon sound-proof principles. This sub-station, the construction of which has attracted considerable interest, is, we believe, the first completely sound- and vibration-proof one erected in this country.

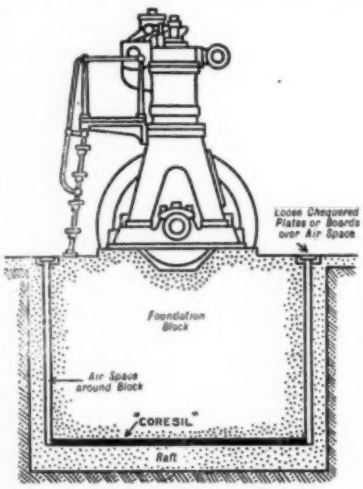


Fig. 3.—Foundation Block on Isolator.

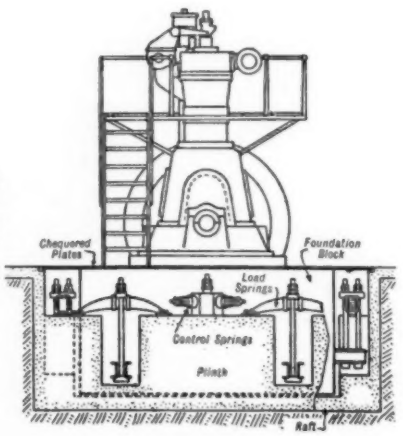


Fig. 4.—Spring-suspended Foundation.

One of the most successful methods of dealing with reciprocating engines is to construct a special concrete foundation upon a layer of "Coresil," fig. 3, leaving an air gap surrounding the main foundation block. This method has been used in connection with all types of power plant, including Diesels up to 3,500 b.h.p. Another method, which is the subject of a patent, fig. 4, is to embed in the foundation block, during construction, a number of joists, the ends of which project about 1 ft. 6 in. beyond the sides of the main block, and arrange a series of leaf springs across the joist ends, connecting the joists and springs by means of bolts and plates. By tightening up the bolts, the whole weight of the block and engine is taken by the springs, upon which the block is free to move. This movement is under control, however, by another arrangement of springs and resilient material, the suitable adjustment of which keeps the movement down to a minimum.

Another method of isolating machinery is by means of special devices called anti-vibrators. These are self-contained devices designed to be placed directly under the base of a machine such as a turbo-generator. A 250-kW geared turbo-generator in the basement at the Savoy Hotel, London, is mounted in this manner.

For the above particulars we are indebted to Messrs. W. Christie & Grey, Ltd., London, who were responsible for the design of the sub-station at Hull.

Rural Electrification in Sweden.

By ALFRED EKSTRÖM, D.Sc.

(Abstract of a lecture delivered before the INSTITUTION OF ELECTRICAL ENGINEERS.)

THE population of Sweden which earns its livelihood by industry is now from three to four times greater than it was in 1920, and should the increase continue at the same rate, by about 1930 the number of persons supporting themselves by industry will be greater than the number engaged in agriculture, which from olden time has been Sweden's primary occupation. The chief reason for this change is to be found in the unprecedented development of technical engineering, which, of course, must be regarded as a sign of progress. But everything has its good and bad sides, and the last few years have shown that Swedish industry has had to fight against great odds to maintain its exports.

The agricultural situation is a still more precarious one, for not only could agriculture never, even approximately, acquire the rational working methods of industry, but it must remain at a great disadvantage in competition with industry by failing to attract the best man-power. This has had grave financial consequences, particularly with regard to the farmers' most important product—corn. While the agricultural producer's necessities of life have risen in price, his own products have not risen proportionately, and it is not to be wondered at that under these circumstances farming is being increasingly abandoned.

It is quite clear that the critical situation in which our most important food-producers find themselves will soon affect the finances of the entire country, and, in my opinion, the remedy lies to a considerable extent in an increased use of electricity for rural purposes.

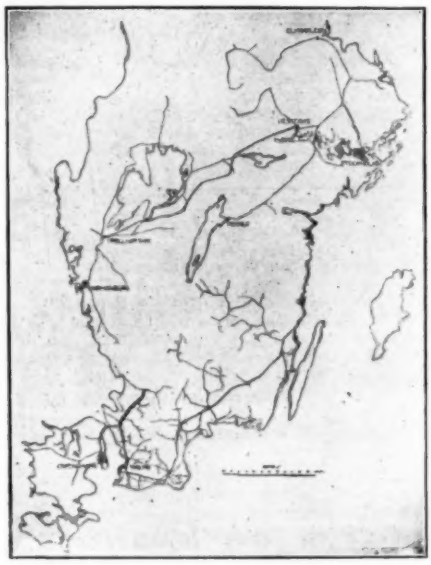


Fig. 1.—South and Central Sweden Distribution System.

Certain causes for the decentralisation of industry have now arisen, and the advantage, both from a social and an economical point of view, of industrial activity in the country —perhaps particularly of small industries and handicraft—is perfectly clear. The first requisite for this, however, is cheap electric power.

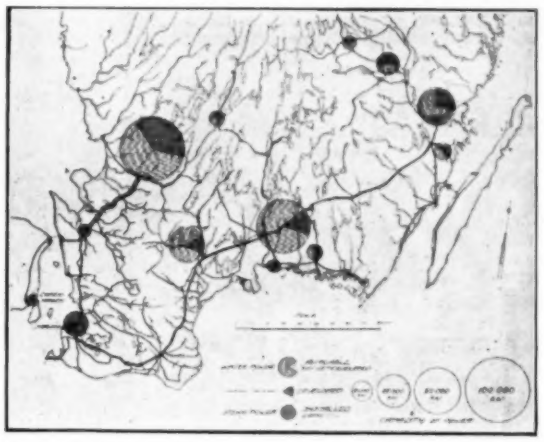
We have numerous examples in the south of Sweden of such workmen, in the country, as smiths and wood carvers, who, after having at first introduced a small electric motor to their shops, have extended their handicraft to prosperous factories employing considerable staffs of helpers.

Generally speaking, cheap power would give an invaluable impetus to the development of industrial enterprise in the country districts. On this point there is nowadays but one opinion. Regarding the question of the most suitable form for the organisation of electrification there are, however, different views, especially as to whether these enterprises should be administered by the State, municipal authorities, or by private enterprise.

The Swedish State has long been in possession of certain waterfalls, and has tried without success to extend its ownership to most of the rapids in the large rivers in Northern Sweden.

By means of its waterfalls, the State, through its organ the Royal Board of Waterfalls, has taken an active part in the electrification of the country, and built waterpower-stations and transmission systems on a vast scale. This activity was at first confined to the great Trollhättan Waterfall in the western part of the country, and was subsequently extended to the Porjus Waterfall in Northern Sweden in connection with the electrification of the Gellivare-Frontier-Narvik Railway for the transport of iron-ore from the pits in the North of Sweden to the ice-free harbour of Narvik on the Norwegian coast. The Alvkarleby Waterfall in Eastern Sweden was then harnessed jointly with Trollhättan for electrifying Central Sweden, where the available water-power resources were not large.

About this time the project for exploiting waterfalls in the Indalsälven River in the North of Sweden began to arouse interest. The Royal Board of Waterfalls determined to do its utmost to induce the State to purchase the most important of these falls. The Socialist movement at this time began to make its influence felt in favour of this idea, and " nationali-



(Light and dark portions of circles, water power undeveloped and developed respectively; cross-shaded circles, installed steam capacity.)

Fig. 2.—South Swedish Power Co. System.

sation of the waterfalls " became a " slogan " that was by no means displeasing to the leading men on the Royal Board of Waterfalls; and the ambitious plans for an extensive State Central (Superpower) System which should connect all the important waterpower stations in Sweden, and make them dependent on the State as the dominating power-producer, were drawn up. The main lines crossing Central Sweden and connecting the power stations at Trollhättan and Alvkarleby with each other were then constructed. A great effort was also made to construct a State-controlled line from Trollhättan to the South of Sweden, but these plans were fortunately frustrated.

The objection has sometimes been raised that private enterprise might acquire all the available water-power resources in particular districts, and thus secure a private monopoly.

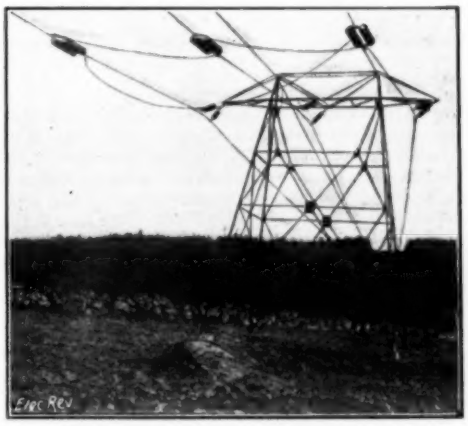


Fig. 3.—130-kV. Anchor Tower.

The fear of this particular danger, in so far as it concerns the supply of energy to rural districts, is unfounded, inasmuch as the share of energy-price due to the cost of transmission is relatively much larger than that for energy production at the power station. The competition with steam power therefore is, in fact, something that the would-be monopolist has always to reckon with, and which will be sufficient to prevent him from thus abusing his position. Besides no actual attempt has ever made to act in such a way.

As the electrification in our country has now developed, neither the State nor private enterprise has assumed or gained

a dominant or overbearing position, and it is desirable that this balance should be maintained in future.

The electrification in Sweden has, by fusions or co-operation of the smaller electrical enterprises, been developed so that the energy supply for the towns, railways, and industrial works, as well as the rural demand, is now being provided by large power-supply enterprises. From a technical-economical point of view, such an organisation on a large scale of the energy supply is of great importance, the advantages of super power transmission thus being taken care of. At present there are two such dominating enterprises, one in Central Sweden, owned by the State, and the other in Southern Sweden, owned by the South-Swedish Power Company.

From the first-mentioned system, with the large water-power plants in Trollhättan and Alvkarleby to which later have been added the water-power plant in Motala and the steam-power station in Vesteras, power is supplied to the whole of Central Sweden, fig. 1.

The South-Swedish Power Company, a fusion of three large power companies in the South of Sweden, is supplying energy from about 20 separate water-power plants and some steam-power stations to the southern parts of Sweden, fig. 1. Both of these large systems, however, co-operate with a number of economically independent power supply companies.

The South Swedish Power Company is also, by means of a 50-kV submarine-cable under Oresund, connected with Denmark, thus co-operating with Copenhagen and the distributing system on Själland.

The large power systems are planned for future inter-connection by means of 220-kV super-power lines, and the State Water-Plants at Trollhättan and Alvkarleby were several years ago connected by a 130-kV line. The main transmission lines generally operate at 50 kV and 50 periods.

At suitable points on these lines are erected secondary transformer stations, where the pressure is stepped down from 50 to 20 kV for the country lines, and to 6 kV for the town supplies. The country lines radiate from these transformer stations, each of which is intended to serve within a radius of 15 to 20 English miles.

The available electric energy developed from the S. Sweden rivers is about 1,500,000,000 kWh per annum.

The future super-power supply system of England, based on electric energy produced by coal in large power stations, will have to collect the energy from several favourably-situated stations at certain points, and from these distribute the energy to the districts for consumption in the same way as is done in South Sweden. The technical and economic experiences, gained in our country, might therefore be of interest.

The map in fig. 2 will give an idea of the utilised capacities of the existing power stations of the South-Swedish Power Co. as well as the available capacities. As mentioned, the main lines in this district work on 50 kV; fig. 3 shows an anchor-tower for one of these lines, provided with arrangements for the transportation of the conductors.

The pressure is rather low for the long distances, but the parallel running and the stability of the power system, with an installed generator capacity of 200,000 kVA, is very good. The difficulties in regard to the regulation of the pressure have been solved in an ingenious way by introducing transformers provided with ratio adjusters which can be operated under load. The long line from north-east to south-west at certain times transmits water-power from the north-east to the south-west, and at other times steam-power from south-west to north-east. At both ends the pressure has to be adjusted from 45 to 60 kV at full load.

In the construction of modern outdoor switchgear this enterprise was a pioneer. The first outdoor sub-station in Europe was built on the system in 1913-14, and several outdoor stations which have been built since will stand comparison with anything of the kind constructed in Europe or America. Fig. 4 shows one of these stations, which will permit an increase of the plant that can never be attained by an indoor station. Moreover, the cost of such an outdoor plant is considerably lower than that of an outdoor one. No difficulties have occurred from ice, snow, or storms; indeed, the security of service is greater than with indoor stations.

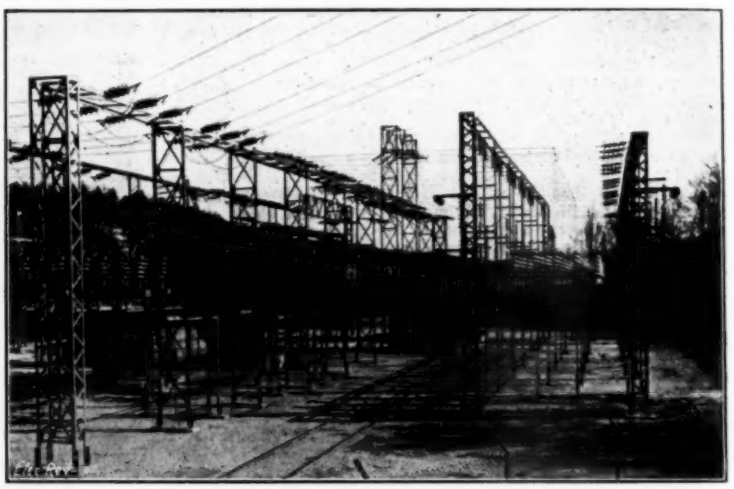


Fig. 4.—Outdoor Sub-station at Hemsjö.

(To be continued.)

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.—During the week ended November 20th three more local circles were formed, *viz.*, at Dartmouth (chairman: Mr. H. Harold), Weston-super-Mare (chairman: Mr. G. Charlton), and Belfast. Further demonstration homes were opened at Dundee, Birmingham, Whitby, and Halifax. The Birmingham home is the fourth arranged by the city. The North-East Coast district has already run four homes, and a further three are being opened within the next two months. Two houses are in preparation at Nottingham, and will probably be opened next week. It is reported that 180,000 people visited the Liverpool demonstration home, and those at Cardiff and Edinburgh are attracting large numbers. Doncaster has arrangements in hand for the opening of an all-electric home. In addition to the house mentioned above, Halifax has another two under consideration. The Corporation has agreed to contribute £102 to the expenses of the campaign in its area, 17 local contractors having subscribed a similar amount. A great deal of publicity work is being done in the town, and even the comedian at a local theatre is assisting by references to the all-electric home. Sheffield is drawing up a scheme to further the campaign in the city. It is reported from Greenock that the campaign has aroused interest in the Corporation's new wiring scheme. The district has been divided up for canvassing purposes, each local contractor taking over a section. At Sunderland a prominent architect commended the competition booklet as a valuable aid in the choice of lighting fittings. Birmingham contractors have traced a number of orders to the demonstration homes and have agreed to provide part of the necessary staff in future. Activity is reported from a number of small towns in the South Wales E.P.D. Company's area.

The next series of advertisements in national newspapers commences on Sunday next. A quarter of a million "chequecoupons" have already been circulated, and nearly 150 model houses have been ordered. The Electrical Development Association asks undertakings to apply for kinema slides and posters to enable them to keep in touch with the public. The results obtained so far show that the new business entirely outweighs the expenditure, in spite of the fact that the organisers were aiming mainly at future business.

The Leeds local committee has taken over the all-electric bungalow erected near the Town Hall during the Tercentenary Celebrations of last July and still standing. The house was formally opened for public demonstrations in domestic lighting and other electrical services, on November 22nd, by Alderman D. Foster, chairman of the Electricity Committee, and is to be open daily until March 31st. Admission is by ticket, obtainable free from the municipal Electricity Department or from local electrical contractors. The electrical fittings and equipment are being changed fortnightly to ensure the continuity of public interest. If the experiment is successful, all-electric demonstration houses will be opened in other parts of the city as occasion offers.

The first all-electric demonstration house at Halifax in connection with the campaign was opened on November 22nd, at Gladstone Road. It is to be open daily from 2 to 9 p.m., for probably a month, and it is intended to arrange other demonstration houses in various parts of the town.

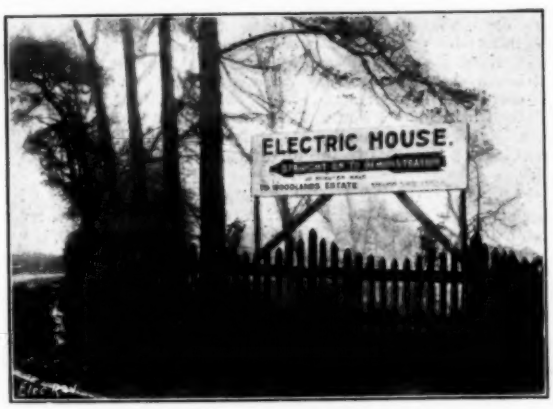
The Dewsbury and Batley Corporations and the Heckmondwike District Council have co-operated with electrical contractors of the area, and with a firm of house furnishers, in the organisation of domestic electrical displays in the three towns, including an all-electric house in each place. The first

of these houses was opened on November 26th at Halifax Road, Dewsbury, on the tramway route from the Spen Valley area.

Birmingham is certainly one of the most active districts in the campaign. The City Electric Supply Department, with the

An Electric Home at Erdington.

aid of local contractors and others, has made a special feature of electric demonstration houses, and one of them (at Erdington) is illustrated herewith. The sign in the second picture is pointing the way to another electric home at Northfield.



Pointing the Way to the Northfield Electric Home.

We illustrate herewith a very ambitious and excellent window display arranged in connection with the campaign by the Bradford Corporation Electricity Department at its showrooms. The "room" is handsomely furnished, and the

Display by the Bradford Electricity Department.

electrical appliances, while in evidence, are not obtrusive, harmonising well with their surroundings. Such an attractive display is the next best thing to an all-electric demonstration house, and probably more people will see it.

Price Reductions.—The LONDON ELECTRIC WIRE CO. AND SMITHS, LTD., announce that owing to increased demand and new methods of production they have made an average reduction of 15 to 20 per cent. in the prices of their plug-in type inductance coils. These are set forth in a new pamphlet just issued.

Non-Ferrous Metal Statistics.—According to the statistics issued by the Metal Bank and Metallurgical Company of Frankfort-on-Main, the world's production of aluminium in 1925 amounted to 180,000 metric tons, as compared with 169,000 metric tons in 1924, and 63,000 tons in 1913. The figures for lead are: 1,499,000 metric tons, 1,291,000 tons, and 1,209,000 tons in the three years, respectively; those for copper: 1,412,000 metric tons, 1,350,000 tons, and 1,025,000 tons; those for zinc: 1,129,000 tons, 1,006,000 tons, and 1,001,000 tons; and those for tin: 146,000 metric tons, 136,000 tons, and 133,000 tons in the three years, respectively.

Electric Cookers for Manchester.—The CABLE ACCESSORIES CO., LTD., has secured a contract for the supply of large type cookers to the Manchester Corporation for the coming year. For this contract the company is supplying its new "Maxime" cooker, which embodies all the latest improvements. Bottom and side heating is employed in the oven, which measures 18 in. high by 16 in. by 16 in. (available cooking space). The whole of the interior is vitreous enamelled. Cast and hinged shields protect the elements and a dished floor prevents ingress of liquid to the bottom element. "Sadia" totally enclosed boiling plates are fitted; these are interchangeable with either the company's semi-enclosed or "Globar" type open plates. A door is provided to the plate warming chamber, and a white vitreous panel to the oven door. Busbar wiring is employed throughout.

Norwegian Nitrogen. — The Norsk Hydro-Elektrisk Kvaelstof A.S. of Notodden reports net profits and balance forward amounting to 4,683,000 kr. in 1925-26 and a dividend at the gross rate of 16s. 3d. per share. If the working results are less favourable than in 1924-25 (when the surplus amounted to about 10,000,000 kr. and the rate of distribution to about 17 per cent.) the report states that the reason is chiefly to be found in the appreciation of the Norwegian krone. The prices obtained for the exported products were practically unchanged in foreign currency, but most of the expenses could not be reduced in proportion to the improvement in the value of the krone. Thus the high wages paid to the workmen under agreement had to be paid until June 1st, 1926, and the reduction then made amounted to 15 per cent. Water supply was favourable, so that the power stations were able to work at a maximum load during the greater part of the year, and the sales of products were satisfactory both in quantity and prices.

Deed of Assignment.—S. E. BLAND, electrical engineer, 82a and 97, Queen Street, E.C.—Particulars of claims by December 9th to the Trustee, Mr. P. S. Booth, Kimberley House, 14-17, Holborn Viaduct, E.C.

Proposed New Buenos Aires Subway.—The reported granting of a concession to a Westminster firm of engineers to construct a tube railway in Buenos Aires led to numerous inquiries at the offices of the Anglo-Argentine Tramways Co., Ltd. In response to these, the following statement was made by Mr. W. D. Dawes, managing director of the company:—"In view of numerous inquiries received by the Anglo-Argentine Tramways Co. concerning statements in the Press that concessions have been granted recently by the municipality of Buenos Aires for the construction of a system of tube or underground railways in that city, the company thinks it desirable to state that it has received authoritative information that no concessions for tube or underground railways in Buenos Aires have been granted other than those held by the company. Major O. Sumner, a member of the firm concerned, said that this statement was technically correct, as before any concession of the magnitude of the one involved was granted, the terms had to be published in the official bulletin 15 days before it became effective. He maintained, however, that the concession would be approved.

Major Sumner later issued a statement to the effect that there was no relation between his firm's operations and those of the Anglo-Argentine Tramways Co. The latter company's project for the construction of a further subway convenience for its trams did not concern Messrs. Sumner, Mayoh and Haley. The City of Buenos Aires had determined to solve its traffic problem in the only logical way.

Employment during October.—The *Ministry of Labour Gazette* for November shows that the percentage of unemployment in the electrical engineering industry was 7.1, as compared with 7.4 per cent. in September last and 5.5 per cent. in October, 1925. The proportion in the engineering industries as a whole rose from 16.3 to 16.4 per cent. In the electrical wiring and contracting industry the proportion of unemployed fell from 9.9 to 9.7 per cent.; in October, 1925, the figure was 6.1 per cent. There was an increase in unemployment in the electric cable and wire and electric lamp manufacturing group—from 6.8 to 7.4 per cent.; in October, 1925, the proportion was 5.5 per cent.

Local Exhibition.—PUDSEY.—An exhibition of domestic electrical appliances was held last week, opened by the Mayor (Councillor S. Myers), and to further encourage the domestic consumption of electricity the Corporation Electricity Department has decided that from January 1st next the charges to householders shall be at a reduced rate based on an annual rateable value charge.

Registration of New South Wales Electricians.—New South Wales already has a law making it compulsory for electrical contractors to become licensed before they can undertake contracts. A board of five was appointed to administer the measure. Now, states the *Sydney Morning Herald*, the Government has adopted a Bill for the compulsory registration of electrical mechanics.

Electricity Supply District Council.—The annual meeting of District Council (No. 2) Electricity Supply Industry (Yorkshire, North Lincolnshire, &c.), was held at Leeds on November 10th. Among other matters the Council decided to adopt the resolution passed by the National Council for the industry reinstating the machinery and agreements which were in force prior to the general strike. A small amendment was suggested relating to the failure of the District and National Councils to arrive at a decision in any dispute.

At a subsequent meeting, Mr. W. H. Proudler (trade union side) was appointed chairman for the ensuing year, and Alderman C. J. Dowson (employers' side) was appointed deputy chairman.

Unemployment.—The registers of the Employment Exchanges showed a total of 1,563,000 unemployed on November 8th, an increase of 3,764 for the week. The number at November 9th, 1925, was 1,198,126.

Export Credits Guarantees.—The amount of credit granted under the Overseas Trade Acts, 1920-26, in respect of electrical goods during the quarter ended September 25th last was only £128.

Trade Announcements.—In consequence of the death of its late chief, Mr. E. A. Graham, the business of ALFRED GRAHAM & CO. is now divided up into two limited companies, of which we gave particulars in our last issue (p. 845), namely, Alfred Graham & Co., Ltd., and Graham Amplion, Ltd. The latter company will undertake the manufacture and sale of Amplion wireless loud speakers and other radio products, together with electric horns and other motor accessories. Mr. Alfred Graham, the founder, has returned to this business, after many years, and has accepted the chairmanship of the board of each company. Messrs. Alfred Graham & Co., Ltd., will continue to operate the naval telephone side of the business and the two companies will be in complete liaison, while many of the directors will serve on both boards. The international organisation which has been created will fall under the control of Graham Amplion, Ltd. This at the moment consists of the following concerns: Amplion Corporation of Canada, Ltd., Toronto; Amplion (Australasia), Ltd., Sydney, N.S.W.; Amplion Corporation of America, New York; Compagnie Continentale "Amplion" S.A., Brussels; and Compagnie Française "Amplion," Paris. Further associated companies are now in course of formation.

THE SAXONIA ELECTRICAL WIRE CO., LTD., have appointed as their sole sales representative in the county of Yorkshire Mr. F. C. Geary, A.M.I.E.E., of 213, Western Road, Sheffield.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., has opened a new Irish "Exide" headquarters at 8, Pearse Street, Dublin, in charge of Mr. E. C. Hart, who has represented the company in Ireland for many years.

MESSRS. EARLE, BOURNE & CO., LTD., of Birmingham, notify us that the address of their Newcastle-on-Tyne office has been changed to: 28, St. Mary's Place.

Owing to increased business in their "Portadyne" wireless receivers, MESSRS. WHITTINGHAM, SMITH & CO. have taken larger premises, for offices, showrooms and works, at 110, Kew Green, Kew, London.

The address of the following companies has been changed to 206, St. Vincent Street, Glasgow, C.2. ('Phone: 3892 Central"):—CLYDE VALLEY ELECTRICAL POWER CO.; LANARKSHIRE HYDRO-ELECTRIC POWER CO.; STRATHCLYDE ELECTRICITY SUPPLY CO., LTD.; KILMALCOLM ELECTRIC LIGHTING CO., LTD.; and the CLYDE VALLEY ACCESSORIES, LTD.

Catalogues and Lists.—BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A 48-page catalogue in a neat case containing illustrated particulars and full prices of the company's a.c. and d.c. small-power control gear.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—An illustrated and priced folder, containing particulars of the "R.I." retroactive tuner, permanent detector multi-ratio transformer, and other radio apparatus.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1057 (supplementary to Pamphlet No. 234) dealing with the "Marconi" 50/75-W portable and semi-portable station.

THE BASTIAN METER CO., LTD., 58, Haymarket, S.W.1.—An illustrated and priced leaflet advertising the "Super Imp" electric fire.

MESSRS. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—Lists Nos. 577 and P1142, illustrating and describing the company's electric fires; and a folder describing the "Ideal" electric hair dryer. Priced.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A coloured showcard (20 in. by 30 in.), advertising "Hart" high- and low-tension batteries for radio purposes.

THE DAMARD LACQUER CO., LTD., Warwick Road, Greet, Birmingham.—Two four-page blotters with bound edges graduated in inches and centimetres, advertising "Damarda" lacquers and "Formite" bakelite products. Also a leaflet advertising "Formite" bakelite cement for steam-pipe joints, &c.

THE RAY MANUFACTURING CO., LTD., 9, Devon Road, Fishponds, Bristol.—Pamphlets advertising the "Andy" fuse wire carrier and the "Symplist" contact test "prods."

THE AUTOMATIC TELEPHONE MFG. CO., LTD., Milton Road, Edge Lane, Liverpool.—An illustrated list, with separate price sheet, dealing with "Claritone" loud speakers and headphones.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Leaflet No. 4102/10, containing details and prices of "Cosmos" decoration electric lamp outfits.

THE ATHOL ENGINEERING CO., Seymour Road, Crumpsall, Manchester.—Pamphlets illustrating and describing the company's reversible valve holder, aerial earthing plugs, coil mounts, &c.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—A series of illustrated pamphlets dealing with the company's motors, instruments, lighting equipment supervisory control, cookers, and other products.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Pamphlet No. 155a, describing in some detail the construction and advantages of the company's "H-type" cable for high pressures.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—A pamphlet illustrating examples of the company's electrostatic voltmeters for works and laboratory use.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta 747, an article on "Tertiary Windings in Power Transformers" by the company's chief designer, reprinted from the ELECTRICAL REVIEW.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue P.208, containing a mass of data relating to overhead transmission lines and illustrated particulars of materials for this purpose.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—Price List No. 146, containing particulars and prices of "Siemens" Christmas tree lighting outfits.

THE SOLUS ELECTRICAL CO., 100, Judd Street, W.C.1.—A well-illustrated catalogue of X-ray equipment, including complete couches, screening stands and tube stands. Prices are given.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—A pamphlet illustrating and describing combined switch-sockets and plugs suitable for electric heater control. Priced.

Bankruptcy Proceedings.—E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, and Magnet House, Kingsway, W.C.—The first meeting of creditors under this failure was held on November 16th at the London Bankruptcy Court, before Mr. Walter Boyle, Senior Official Receiver. The debtor has stated that on leaving school he was trained as an electrical engineer; he served during the war, and upon being demobilised with the rank of captain, he resumed his engagement with an electrical company, by which he was still employed. He returned liabilities of £1,100, which included a claim of £700 in respect of income tax, and assets of little value. The meeting was adjourned till December 7th to enable the debtor to submit a proposal to the creditors.

P. F. BRITTAIN (trading as Brittain's Electric Motor Co.), electrical engineer, 110, Cannon Street, E.C., and Dermody Road, Lewisham.—The public examination of this debtor was held on November 17th, before Mr. Registrar Warmington, at the London Bankruptcy Court. The debtor petitioned the Court on September 1st, and has lodged accounts showing total liabilities of £6,844 (unsecured £3,026), and assets valued at £15,904, after deducting £228 for payment of the preferential claims. Questioned by the Official Receiver, debtor said he had carried on business as an electrical engineer since 1898, and also as a bronze founder under the style of "Armstrong & Co." In 1912 he purchased the assets of an engineering company for £3,000, and commenced business as "Brittain's Electric Motor Co." at Lewisham. The business was successful until 1921, but it had since been affected by industrial strikes and by foreign competition. Owing to executions having been levied at his business premises in August last he filed his petition. Witness had also acted as director of two limited companies. He did not admit that he was insolvent, and attributed his failure to trade depression, and to his inability to obtain money with which to discharge the debts of the execution creditors. The examination was concluded.

The following are creditors:—

	£
Airedale Electrical & Mfg. Co., Ltd.	45
Bull Motors, Ltd.	102
Draper, Ltd.	31
Electrical Apparatus Co., Ltd.	93
ELECTRICAL REVIEW, Ltd.	83
Electrical Press, Ltd.	30
Electro Dynamic Construction Co., Ltd.	61
Ellison, George	105
Flather & Co.	47
Gerhard & Hey, Ltd.	21
Goodbrook, H., & Sons	23
Grand Hotel, Eastbourne	24
Grey & Martin	22
Gwynne's Eng. Co., Ltd.	37
Jenson & Nicholson, Ltd.	57
Jones, Chalk & Dawson	142
Lukey, J., & Sons, Ltd.	29
Maddock, J., & Co., Ltd.	34
Marshall & Snelgrove	36
Mathews, E., Ltd.	25
Midland Electric Wire Co.	49
Morgan Crucible Co., Ltd.	41
Premier Electric Control Co.	920
Robinson, J. H., & Sons	54
Sankey, J., & Sons, Ltd.	140
S. Met. Elec. Light & Power Co., Ltd.	68
Walker, Brandon & Co.	570
Wenley, Ltd.	61

L. A. WOODHEAD, wireless dealer, 25a, Charles Street, Bradford.—First and final dividend of 7s. 2½d. in the £, payable at the Official Receiver's Office, 12, Duke Street, Bradford.

R. L. BROCK (R. L. Brock & Co.), electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth.—First meeting held November 24th, at 11, St. Aubyn Street, Devonport. Public examination, December 31st, at the Western Law Courts, Guildhall, Plymouth.

H. BEBBINGTON, electrical engineer, 14, Cestrian Street, Bolton.—Receiving order made November 16th on debtor's own petition.

H. E. PARRIS (St. George's Electrical Manufacturing Co.), 134, Upper Thames Street, E.C., and 20, High Street, Sydenham.—Application for discharge to be heard December 14th at Carey Street, W.C.

W. HEANEY, electrician, 12, Market Place, Henley-on-Thames.—First meeting held November 24th, at 29, Russell Square, W.C.1. Public examination, December 2nd, at the Assize Courts, Reading.

F. H. THOMAS, electrical engineer, carrying on business in co-partnership with W. E. Evans, as Thomas & Evans, Salubrious Chambers, Salubrious Passage, Swansea.—Application for discharge to be heard on December 15th, at the Town Hall, Swansea.

W. A. A. C. ROBINSON, electrical engineer, 10, Carnaby Street, Golden Square, W.C.—Trustee, Mr. A. Williams, Official Receiver, Carey Street, W.C., released November 10th.

W. H. GREENALL (Hampton Electric Co.), electrician, Newerne Street, Lydney.—First and final dividend of 8¼d. in the £, payable at the Official Receiver's office, 34, Park Place, Cardiff.

R. FENTON, electrical engineer, 74, Park Road, and late of 514, Sheffield Road, Chesterfield.—Receiving order made November 11th, on debtor's own petition. First meeting, November 26th, at the Official Receiver's office, 4, Castle Place, Nottingham. Public examination, December 10th, at the County Court, Chesterfield.

A. J. MCMAHON, electrical contractor, 51, St. Thomas Street, Weymouth, and Melcombe Regis.—Receiving order made November 12th, on debtor's own petition.

A. J. WELLS, lately carrying on business in partnership with W. Bashford as Wells & Co., electrical engineers, 52, Princess Street, Luton.—First meeting held November 24th, at the Official Receiver's office, The Parade, Northampton. Public examination, December 16th, at the Court House, Luton.

Company Liquidations.—BRITISH ELECTRIC VEHICLES, LTD., 36-7, Old Jewry, E.C.—The first meetings of the creditors and shareholders were held last week at Carey Street, W.C., before Mr. E. T. A. Phillips, Official Receiver. Particulars of the liquidation appeared in our issue of November 12th. The proceedings were merely formal, the chairman remarking that his observations had been circulated among the creditors and shareholders. A resolution was passed by the creditors for the Official Receiver to remain in charge of the liquidation, and the meeting of contributories was formally adjourned in the absence of a quorum, it being intimated that no outside liquidator was desired by that body.

The following are the principal creditors:—

	£		£
Avon India Rubber Co., Ltd. ...	36	International Exhibitions, Ltd. ...	40
Allen, W., Ltd.	45	James Thos., & Co.	129
Batteries, Ltd.	423	Locomotive Publishing Co., Ltd.	25
Bouthroyd, H. T., Ltd.	366	Machinery Publishing Co., Ltd.	37
British Griffin Chilled Iron and Steel Co., Ltd.	104	Metropolitan-Vickers Electrical Co., Ltd.	130
Brown, Duncan & Co.	142	Midland Tank and Iron Co., Ltd.	38
Bunyan Shield Hood Co., Ltd.	383	Mild Steel Castings, Ltd. ...	51
Campbell & Isherwood, Ltd. ...	238	Powell Bros., Ltd.	63
Chloride Electrical Storage Co., Ltd.	725	Ransome & Marles Bearing Co. Ltd.	33
Connolly, T.	22	Sanderson Bros. & Newbould, Ltd.	41
David Brown & Sons, Ltd. ...	28	Skefko Ball Bearing Co., Ltd. ...	38
Davies, A. J.	28	Spencer, Moulton & Co., Ltd. ...	23
Duckworth Bros.	148	Stewart Thompson Patrick, Ltd.	213
Edison Accumulators, Ltd. ...	38	Strahan Murray	46
ELECTRICAL REVIEW	30	Syren & Shipping, Ltd.	52
Electric Vehicle	23	Vulcan Motor and Engineering Co., Ltd.	24
Electro-Mechanical Brake Co., Ltd.	25	Wingrove & Rogers	355
Gaynor, John, & Co.	51	White, R., & Sons	104
Hewittic Electric Co., Ltd. ...	71	Dudley Wood, R.	50

DE LEEUW & CO., LTD., Sentinel House, Southampton Row, W.C.—The first meetings of creditors and shareholders were held on November 17th, at Carey Street, W.C., a compulsory winding up order having been made on October 13th. Mr. J. Barwick Thompson, Official Receiver, reported that the company was registered as a private company on April 30th, 1925, with a nominal capital of £500, subsequently increased to £10,000, and was formed to carry on business as general agents and dealers in radio appliances and electrical apparatus. Mr. Henry de Leeuw was appointed managing director for one year at a salary of £20 a week, but resolutions were subsequently passed (although no confirmation could be traced) increasing the amount to £40 a week and the term of office to 10 years. Owing to the very imperfect state of the books, it had been impossible to ascertain exactly what had been paid to Mr. de Leeuw, but the salary list, which showed the managing director's fee at £20 a week, the secretary's salary £10, the technical adviser £5, and a fee of £8 a week to a director who subscribed for 500 shares, amounted to £2,236 per annum, whilst the trading account from the receipts of the company to May 22nd, 1926, disclosed a net loss of £1,920. Under an agreement dated May 4th, 1925, the company acquired Mr. de Leeuw's interest in certain agency agreements, the consideration being £500 in cash, but by means of a book entry the cash was credited against 500 ordinary shares allotted to Mr. de Leeuw. The issued capital was the £500 ordinary shares thus allotted, and £2,650 preference shares subscribed for cash. The business principally consisted of the sale of Freed-Eismann radio sets and components. An agreement was stated to have been entered into with that company under which this company undertook to take certain quantities of sets to be delivered to agents in London from whom the company acquired them for cash as and when required. In October, 1925, Mr. de Leeuw went to America with the object of obtaining confirmation of the agreement with the Freed-Eismann Co., and for the expenses of that journey a loan of £200 was obtained from moneylenders. Mr. de Leeuw had not rendered an account of that loan. In March, 1926, he obtained £500 from another moneylender against cheques drawn on the company's banking account. That was alleged to have been done without the knowledge of his co-directors, and the proceeds were used by Mr. de Leeuw in the purchase of £500 preference shares of the company. In April, 1926, a further £200 was borrowed from a third moneylender on a promissory note for £280, signed for the company by Mr. de Leeuw and another director. Repayment was to be made by four equal instalments of £70; only the first instalment was met, and in default of payment of the second a petition was presented upon which the winding up order was made. That loan of £200 was said to have been required for the purpose of meeting certain American drafts. Owing to the unsatisfactory financial position of the company which had been brought about by the transactions entered into by Mr. de Leeuw, he was requested to resign, and the company's auditors were instructed to investigate the position and prepare accounts. It appeared from the report furnished that extreme difficulty had been experienced in preparing accounts owing to the condition of the books and the absence of necessary documents and vouchers. It had been impossible to obtain any explanation from Mr. de Leeuw as he had left the country, and although he was believed to be in Holland, his present whereabouts could not be ascertained. The liabilities were returned at approximately £2,690; the assets were not expected to realise £100; the failure was attributed to heavy overhead charges and extravagance on the part of Mr. de Leeuw. The liquidation was left in the hands of the Official Receiver.

MODERN RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. T. M. Richardson, 54, Cloth Market, Newcastle-upon-Tyne.

BELGRAVIA ELECTRICAL CO., LTD.—A meeting of members is called for December 17th, at 21, Ironmonger Lane, E.C., to hear an account of the winding up from the Liquidator, Mr. W. H. Lovatt.

SOUTHERN RADIO SUPPLIES, LTD.—A meeting of members is called for December 20th at the offices of Messrs. Edmonds, Clover & Jones, Barclay Bank Chambers, Terminus Road, Eastbourne, to hear an account of the winding up from the Liquidator, Mr. P. M. Jones.

GWYNNES, LTD.—First meetings of creditors and contributories to-day (Friday) at Carey Street, W.C.

Wages in the Contracting Industry.—The National Federated Electrical Association states that the rates mentioned in its recent circular remain in force until the first pay day in February, 1927, and not January, 1927, as given in the circular. We repeat the rates for the information of those concerned:—Grade A, 1s. 10d. (including a travelling allowance); Grade B, 1s. 7¾d.; Grade C, 1s. 6¼d.; and Grade D, 1s. 5d.

New Belgian Companies.—Among the companies recently formed in Belgium are the following:—Trefilerie et Câblerie du Centre, à la Louviere, capital 2 million fr., to manufacture wires and cables, insulating materials, &c.; la Cie Générale Belge de Travaux Industriels (Cogeti), capital 2 million fr., to manufacture and sell, *inter alia*, electrical machinery and apparatus; Electricité de Chaineux et Environs, capital, 25,000 fr., to supply electricity in the Chaineux and neighbouring districts.

E.D.A. Activities.—The British Electrical Development Association is not so occupied with the campaign as to have forgotten the imminence of Christmas. Once again the idea of electrical gifts is being instilled into the minds of the public by means of attractive pamphlets old and new. One of them suggests an appropriate present for each member of the family and others briefly describe the merits of electric toasters, kettles, fires, irons and other appliances. One novelty is a Christmas cracker arranged to reveal illustrations of a number of devices when the ends are pulled. In this connection, we may draw our readers' attention to the fact that we are commencing a series of electrical Christmas gift suggestions in this issue.

Chinese Notes.—Electric light companies are being formed at Wuwei, Anhwei province (the Chih Ming Electric Light Co.), and at Tungchow (the Tung Kwang Electric Light Co.).

It is proposed to erect a modern rice mill, electrically equipped, in Tungshan, an island near Amoy (Fukien). The promoters would also supply electricity for public use. A sum of $100,000 is being raised to purchase plant from Shanghai.

The Chapei Electricity & Waterworks Co., Ltd., has invited tenders for the supply of two 10,000-kW turbo-generators and other additions to its plant estimated to cost in the aggregate about $2,000,000. The power will be transmitted a distance of 21 miles by a duplicate overhead line to three "super substations" at a pressure of 33,000 V.

A long-distance radio-telephone service was recently inaugurated between Harbin and Mukden, and has proved successful.

The Kellogg Switchboard & Supply Co., Shanghai, has secured a contract for the erection of a broadcasting station in Harbin for the Government. This is the first contract of its kind in China.

"Sweep!"—Chimney sweepers are finding that the coal stoppage is having adverse effects on their occupation, since gas fires and electric heaters are being increasingly used in many houses.—*Christian World.*

Electricity Supply District Council.—The annual meeting of District Council (No. 2) Electricity Supply Industry (Yorkshire, North Lincolnshire, &c.), was held at Leeds on November 10th. Among other matters the Council decided to adopt the resolution passed by the National Council for the industry reinstating the machinery and agreements which were in force prior to the general strike. A small amendment was suggested relating to the failure of the District and National Councils to arrive at a decision in any dispute.

At a subsequent meeting, Mr. W. H. Proudler (trade union side) was appointed chairman for the ensuing year, and Alderman C. J. Dowson (employers' side) was appointed deputy chairman.

Unemployment.—The registers of the Employment Exchanges showed a total of 1,563,000 unemployed on November 8th, an increase of 3,764 for the week. The number at November 9th, 1925, was 1,198,126.

Export Credits Guarantees.—The amount of credit granted under the Overseas Trade Acts, 1920-26, in respect of electrical goods during the quarter ended September 25th last was only £128.

Trade Announcements.—In consequence of the death of its late chief, Mr. E. A. Graham, the business of ALFRED GRAHAM & CO. is now divided up into two limited companies, of which we gave particulars in our last issue (p. 845), namely, Alfred Graham & Co., Ltd., and Graham Amplion, Ltd. The latter company will undertake the manufacture and sale of Amplion wireless loud speakers and other radio products, together with electric horns and other motor accessories. Mr. Alfred Graham, the founder, has returned to this business, after many years, and has accepted the chairmanship of the board of each company. Messrs. Alfred Graham & Co., Ltd., will continue to operate the naval telephone side of the business and the two companies will be in complete liaison, while many of the directors will serve on both boards. The international organisation which has been created will fall under the control of Graham Amplion, Ltd. This at the moment consists of the following concerns: Amplion Corporation of Canada, Ltd., Toronto; Amplion (Australasia), Ltd., Sydney, N.S.W.; Amplion Corporation of America, New York; Compagnie Continentale "Amplion" S.A., Brussels; and Compagnie Francaise "Amplion," Paris. Further associated companies are now in course of formation.

THE SAXONIA ELECTRICAL WIRE CO., LTD., have appointed as their sole sales representative in the county of Yorkshire Mr. F. C. Geary, A.M.I.E.E., of 213, Western Road, Sheffield.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., has opened a new Irish "Exide" headquarters at 8, Pearse Street, Dublin, in charge of Mr. E. C. Hart, who has represented the company in Ireland for many years.

MESSRS. EARLE, BOURNE & CO., LTD., of Birmingham, notify us that the address of their Newcastle-on-Tyne office has been changed to: 28, St. Mary's Place.

Owing to increased business in their "Portadyne" wireless receivers, MESSRS. WHITTINGHAM, SMITH & CO. have taken larger premises, for offices, showrooms and works, at 110, Kew Green, Kew, London.

The address of the following companies has been changed to 206, St. Vincent Street, Glasgow, C.2. ('Phone: 3892 Central"):—CLYDE VALLEY ELECTRICAL POWER CO.; LANARKSHIRE HYDRO-ELECTRIC POWER CO.; STRATHCLYDE ELECTRICITY SUPPLY CO., LTD.; KILMALCOLM ELECTRIC LIGHTING CO., LTD.; and the CLYDE VALLEY ACCESSORIES, LTD.

Catalogues and Lists.—BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A 48-page catalogue in a neat case containing illustrated particulars and full prices of the company's a.c. and d.c. small-power control gear.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—An illustrated and priced folder, containing particulars of the "R.I." retroactive tuner, permanent detector multi-ratio transformer, and other radio apparatus.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1057 (supplementary to Pamphlet No. 234) dealing with the "Marconi" 50/75-W portable and semi-portable station.

THE BASTIAN METER CO., LTD., 58, Haymarket, S.W.1.—An illustrated and priced leaflet advertising the "Super Imp" electric fire.

MESSRS. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—Lists Nos. 577 and P1142, illustrating and describing the company's electric fires; and a folder describing the "Ideal" electric hair dryer. Priced.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A coloured showcard (20 in. by 30 in.), advertising "Hart" high- and low-tension batteries for radio purposes.

THE DAMARD LACQUER CO., LTD., Warwick Road, Greet, Birmingham.—Two four-page blotters with bound edges graduated in inches and centimetres, advertising "Damarda" lacquers and "Formite" bakelite products. Also a leaflet advertising "Formite" bakelite cement for steam-pipe joints, &c.

THE RAY MANUFACTURING CO., LTD., 9, Devon Road, Fishponds, Bristol.—Pamphlets advertising the "Andy" fuse wire carrier and the "Symplist" contact test "prods."

THE AUTOMATIC TELEPHONE MFG. CO., LTD., Milton Road, Edge Lane, Liverpool.—An illustrated list, with separate price sheet, dealing with "Claritone" loud speakers and headphones.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Leaflet No. 4102/10, containing details and prices of "Cosmos" decoration electric lamp outfits.

THE ATHOL ENGINEERING CO., Seymour Road, Crumpsall, Manchester.—Pamphlets illustrating and describing the company's reversible valve boiler, aerial earthing plugs, coil mounts, &c.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—A series of illustrated pamphlets dealing with the company's motors, instruments, lighting equipment supervisory control, cookers, and other products.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Pamphlet No. 155a, describing in some detail the construction and advantages of the company's "H-type" cable for high pressures.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—A pamphlet illustrating examples of the company's electrostatic voltmeters for works and laboratory use.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta 747, an article on "Tertiary Windings in Power Transformers" by the company's chief designer, reprinted from the ELECTRICAL REVIEW.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue P.208, containing a mass of data relating to overhead transmission lines and illustrated particulars of materials for this purpose.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—Price List No. 146, containing particulars and prices of "Siemens" Christmas tree lighting outfits.

THE SOLUS ELECTRICAL CO., 100, Judd Street, W.C.1.—A well-illustrated catalogue of X-ray equipment, including complete couches, screening stands and tube stands. Prices are given.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—A pamphlet illustrating and describing combined switch-sockets and plugs suitable for electric heater control. Priced.

Bankruptcy Proceedings.—E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, and Magnet House, Kingsway, W.C.—The first meeting of creditors under this failure was held on November 16th at the London Bankruptcy Court, before Mr. Walter Boyle, Senior Official Receiver. The debtor has stated that on leaving school he was trained as an electrical engineer; he served during the war, and upon being demobilised with the rank of captain, he resumed his engagement with an electrical company, by which he was still employed. He returned liabilities of £1,100, which included a claim of £700 in respect of income tax, and assets of little value. The meeting was adjourned till December 7th to enable the debtor to submit a proposal to the creditors.

P. F. BRITTAIN (trading as Brittain's Electric Motor Co.), electrical engineer, 110, Cannon Street, E.C., and Dermody Road, Lewisham.—The public examination of this debtor was held on November 17th, before Mr. Registrar Warmington, at the London Bankruptcy Court. The debtor petitioned the Court on September 1st, and has lodged accounts showing total liabilities of £6,844 (unsecured £3,026), and assets valued at £15.904, after deducting £228 for payment of the preferential claims. Questioned by the Official Receiver, debtor said he had carried on business as an electrical engineer since 1898, and also as a bronze founder under the style of "Armstrong & Co." In 1912 he purchased the assets of an engineering company for £3,000, and commenced business as "Brittain's Electric Motor Co." at Lewisham. The business was successful until 1921, but it had since been affected by industrial strikes and by foreign competition. Owing to executions having been levied at his business premises in August last he filed his petition. Witness had also acted as director of two limited companies. He did not admit that he was insolvent, and attributed his failure to trade depression, and to his inability to obtain money with which to discharge the debts of the execution creditors. The examination was concluded.

The following are creditors:—

	£		£
Airedale Electrical & Mfg. Co., Ltd.	45	Jenson & Nicholson, Ltd.	57
Bull Motors, Ltd.	102	Jones, Chalk & Dawson	142
Draper, Ltd.	31	Lukey, J., & Sons, Ltd.	29
Electrical Apparatus Co., Ltd.	93	Maddock, J., & Co., Ltd.	34
Electrical Review, Ltd.	83	Marshall & Snelgrove	36
Electrical Press, Ltd.	30	Mathews, E., Ltd.	25
Electro Dynamic Construction Co., Ltd.	61	Midland Electric Wire Co.	40
Ellison, George	105	Morgan Crucible Co., Ltd.	41
Flather & Co.	47	Premier Electric Control Co.	920
Gerhard & Hey, Ltd.	21	Robinson, J. H., & Sons	54
Goodbrook, H., & Sons	23	Sankey, J., & Sons, Ltd.	146
Grand Hotel, Eastbourne	24	S. Met. Elec. Light & Power Co., Ltd.	68
Grey & Martin	22	Walker, Brandon & Co.	570
Gwynne's Eng. Co., Ltd.	37	Wenley, Ltd.	61

L. A. WOODHEAD, wireless dealer, 25a, Charles Street, Bradford.—First and final dividend of 7s. 2½d. in the £, payable at the Official Receiver's Office, 12, Duke Street, Bradford.

R. L. BROCK (R. L. Brock & Co.), electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth.—First meeting held November 24th, at 11, St. Aubyn Street, Devonport. Public examination, December 31st, at the Western Law Courts, Guildhall, Plymouth.

H. BEBBINGTON, electrical engineer, 14, Cestrian Street, Bolton.—Receiving order made November 16th on debtor's own petition.

H. E. PARRIS (St. George's Electrical Manufacturing Co.), 134, Upper Thames Street, E.C., and 20, High Street, Sydenham.—Application for discharge to be heard December 14th at Carey Street, W.C.

W. HEANEY, electrician, 12, Market Place, Henley-on-Thames.—First meeting held November 24th, at 29, Russell Square, W.C.1. Public examination, December 2nd, at the Assize Courts, Reading.

F. H. THOMAS, electrical engineer, carrying on business in co-partnership with W. E. Evans, as Thomas & Evans, Salubrious Chambers, Salubrious Passage, Swansea.—Application for discharge to be heard on December 15th, at the Town Hall, Swansea.

W. A. A. C. ROBINSON, electrical engineer, 10, Carnaby Street, Golden Square, W.C.—Trustee, Mr. A. Williams, Official Receiver, Carey Street, W.C., released November 10th.

W. H. GREENALL (Hampton Electric Co.), electrician, Newerne Street, Lydney.—First and final dividend of 8¼d. in the £, payable at the Official Receiver's office, 34, Park Place, Cardiff.

R. FENTON, electrical engineer, 74, Park Road, and late of 514, Sheffield Road, Chesterfield.—Receiving order made November 11th, on debtor's own petition. First meeting, November 26th, at the Official Receiver's office, 4, Castle Place, Nottingham. Public examination, December 10th, at the County Court, Chesterfield.

A. J. MCMAHON, electrical contractor, 51, St. Thomas Street, Weymouth, and Melcombe Regis.—Receiving order made November 12th, on debtor's own petition.

A. J. WELLS, lately carrying on business in partnership with W. Bashford as Wells & Co., electrical engineers, 52, Princess Street, Luton.—First meeting held November 24th, at the Official Receiver's office, The Parade, Northampton. Public examination, December 16th, at the Court House, Luton.

Company Liquidations.—BRITISH ELECTRIC VEHICLES, LTD., 36-7, Old Jewry, E.C.—The first meetings of the creditors and shareholders were held last week at Carey Street, W.C., before Mr. E. T. A. Phillips, Official Receiver. Particulars of the liquidation appeared in our issue of November 12th. The proceedings were merely formal, the chairman remarking that his observations had been circulated among the creditors and shareholders. A resolution was passed by the creditors for the Official Receiver to remain in charge of the liquidation, and the meeting of contributories was formally adjourned in the absence of a quorum, it being intimated that no outside liquidator was desired by that body.

The following are the principal creditors:—

	£		£
Avon India Rubber Co., Ltd. ...	36	International Exhibitions, Ltd. ...	40
Allen, W., Ltd.	45	James Thos., & Co.	129
Batteries, Ltd.	423	Locomotive Publishing Co., Ltd.	25
Bouthroyd, H. T., Ltd.	366	Machinery Publishing Co., Ltd.	37
British Griffin Chilled Iron and Steel Co., Ltd.	104	Metropolitan-Vickers Electrical Co., Ltd.	130
Brown, Duncan & Co.	142	Midland Tank and Iron Co., Ltd.	38
Bunyan Shield Hood Co., Ltd.	383	Mild Steel Castings, Ltd. ...	51
Campbell & Isherwood, Ltd. ...	238	Powell Bros., Ltd.	63
Chloride Electrical Storage Co., Ltd.	725	Ransome & Marles Bearing Co.	33
Connolly, T.	22	Sanderson Bros. & Newbould, Ltd.	41
David Brown & Sons, Ltd. ...	28	Skefko Ball Bearing Co., Ltd. ...	38
Davies, A. J.	28	Spencer, Moulton & Co., Ltd. ...	23
Duckworth Bros.	148	Stewart Thompson Patrick, Ltd.	213
Edison Accumulators, Ltd. ...	38	Strahan Murray	46
ELECTRICAL REVIEW	30	Syren & Shipping, Ltd.	52
Electric Vehicle	23	Vulcan Motor and Engineering Co., Ltd.	24
Electro-Mechanical Brake Co., Ltd.	25	Wingrove & Rogers	355
Gaynor, John, & Co.	51	White, R., & Sons	104
Hewittic Electric Co., Ltd. ...	71	Dudley Wood, R.	50

DE LEEUW & CO., LTD., Sentinel House, Southampton Row, W.C.—The first meetings of creditors and shareholders were held on November 17th, at Carey Street, W.C., a compulsory winding up order having been made on October 13th. Mr. J. Barwick Thompson, Official Receiver, reported that the company was registered as a private company on April 30th, 1925, with a nominal capital of £500, subsequently increased to £10,000, and was formed to carry on business as general agents and dealers in radio appliances and electrical apparatus. Mr. Henry de Leeuw was appointed managing director for one year at a salary of £20 a week, but resolutions were subsequently passed (although no confirmation could be traced) increasing the amount to £40 a week and the term of office to 10 years. Owing to the very imperfect state of the books, it had been impossible to ascertain exactly what had been paid to Mr. de Leeuw, but the salary list, which showed the managing director's fee at £20 a week, the secretary's salary £10, the technical adviser £5, and a fee of £8 a week to a director who subscribed for 500 shares, amounted to £2,236 per annum, whilst the trading account from the receipts of the company to May 22nd, 1926, disclosed a net loss of £1,930. Under an agreement dated May 4th, 1925, the company acquired Mr. de Leeuw's interest in certain agency agreements, the consideration being £500 in cash, but by means of a book entry the cash was credited against 500 ordinary shares allotted to Mr. de Leeuw. The issued capital was the £500 ordinary shares thus allotted, and £2,650 preference shares subscribed for cash. The business principally consisted of the sale of Freed-Eismann radio sets and components. An agreement was stated to have been entered into with that company under which this company undertook to take certain quantities of sets to be delivered to agents in London from whom the company acquired them for cash as and when required. In October, 1925, Mr. de Leeuw went to America with the object of obtaining confirmation of the agreement with the Freed-Eismann Co., and for the expenses of that journey a loan of £200 was obtained from moneylenders. Mr. de Leeuw had not rendered an account of that loan. In March, 1926, he obtained £500 from another moneylender against cheques drawn on the company's banking account. That was alleged to have been done without the knowledge of his co-directors, and the proceeds were used by Mr. de Leeuw in the purchase of £500 preference shares of the company. In April, 1926, a further £200 was borrowed from a third moneylender on a promissory note for £280, signed for the company by Mr. de Leeuw and another director. Repayment was to be made by four equal instalments of £70; only the first instalment was met, and in default of payment of the second a petition was presented upon which the winding up order was made. That loan of £200 was said to have been required for the purpose of meeting certain American drafts. Owing to the unsatisfactory financial position of the company which had been brought about by the transactions entered into by Mr. de Leeuw, he was requested to resign, and the company's auditors were instructed to investigate the position and prepare accounts. It appeared from the report furnished that extreme difficulty had been experienced in preparing accounts owing to the condition of the books and the absence of necessary documents and vouchers. It had been impossible to obtain any explanation from Mr. de Leeuw as he had left the country, and although he was believed to be in Holland, his present whereabouts could not be ascertained. The liabilities were returned at approximately £2,690; the assets were not expected to realise £100; the failure was attributed to heavy overhead charges and extravagance on the part of Mr. de Leeuw. The liquidation was left in the hands of the Official Receiver.

MODERN RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. T. M. Richardson, 54, Cloth Market, Newcastle-upon-Tyne.

BELGRAVIA ELECTRICAL CO., LTD.—A meeting of members is called for December 17th, at 21, Ironmonger Lane, E.C., to hear an account of the winding up from the Liquidator, Mr. W. H. Lovatt.

SOUTHERN RADIO SUPPLIES, LTD.—A meeting of members is called for December 20th at the offices of Messrs. Edmonds, Clover & Jones, Barclay Bank Chambers, Terminus Road, Eastbourne, to hear an account of the winding up from the Liquidator, Mr. P. M. Jones.

GWYNNES, LTD.—First meetings of creditors and contributories to-day (Friday) at Carey Street, W.C.

Wages in the Contracting Industry.—The National Federated Electrical Association states that the rates mentioned in its recent circular remain in force until the first pay day in February, 1927, and not January, 1927, as given in the circular. We repeat the rates for the information of those concerned:—Grade A, 1s. 10d. (including a travelling allowance); Grade B, 1s. 7¼d.; Grade C, 1s. 6¼d.; and Grade D, 1s. 5d.

New Belgian Companies.—Among the companies recently formed in Belgium are the following:—Trefilerie et Câblerie du Centre, à la Louviere, capital 2 million fr., to manufacture wires and cables, insulating materials, &c.; la Cie Générale Belge de Travaux Industriels (Cogeti), capital 2 million fr., to manufacture and sell, *inter alia*, electrical machinery and apparatus; Electricité de Chaineux et Environs, capital, 25,000 fr., to supply electricity in the Chaineux and neighbouring districts.

E.D.A. Activities.—The British Electrical Development Association is not so occupied with the campaign as to have forgotten the imminence of Christmas. Once again the idea of electrical gifts is being instilled into the minds of the public by means of attractive pamphlets old and new. One of them suggests an appropriate present for each member of the family and others briefly describe the merits of electric toasters, kettles, fires, irons and other appliances. One novelty is a Christmas cracker arranged to reveal illustrations of a number of devices when the ends are pulled. In this connection, we may draw our readers' attention to the fact that we are commencing a series of electrical Christmas gift suggestions in this issue.

Chinese Notes.—Electric light companies are being formed at Wuwei, Anhwei province (the Chih Ming Electric Light Co.), and at Tungchow (the Tung Kwang Electric Light Co.).

It is proposed to erect a modern rice mill, electrically equipped, in Tungshan, an island near Amoy (Fukien). The promoters would also supply electricity for public use. A sum of $100,000 is being raised to purchase plant from Shanghai.

The Chapei Electricity & Waterworks Co., Ltd., has invited tenders for the supply of two 10,000-kW turbo-generators and other additions to its plant estimated to cost in the aggregate about $2,000,000. The power will be transmitted a distance of 21 miles by a duplicate overhead line to three "super substations" at a pressure of 33,000 V.

A long-distance radio-telephone service was recently inaugurated between Harbin and Mukden, and has proved successful.

The Kellogg Switchboard & Supply Co., Shanghai, has secured a contract for the erection of a broadcasting station in Harbin for the Government. This is the first contract of its kind in China.

"Sweep!"—Chimney sweepers are finding that the coal stoppage is having adverse effects on their occupation, since gas fires and electric heaters are being increasingly used in many houses.—*Christian World.*

Book Notices.—" Statement and Engineering Report by the Hydro-Electric Power Commission of Ontario submitted to the International Joint Commission respecting the proposal to develop the St. Lawrence River." (119 pp., 13 plates.) Toronto: The Hydro-Electric Power Commission.—This report, prepared in 1921, has been re-issued with supplementary data bringing it up to the year 1925. The report is not for general distribution and only a limited number of copies are available at the price of $7.50 each.

Annual Report of the Dominion Water Power and Reclamation Service, 1924-25 (85 pp.). Ottawa: F. A. Acland, Government Printer.—This contains, *inter alia*, a review of the potential and developed water power in the whole of Canada.

The " Express " Metric Quotation Reckoner for converting quotations in British sizes and weights to a metric basis. Pp. 96. London: Gall & Inglis. Price 2s. 6d.

Journal of the Institution of Electrical Engineers. Vol. LXIV. November, 1926. No. 359 and Index. London: E. and F. N. Spon, Ltd. Price 10s. 6d.

Journal of the American Institute of Electrical Engineers. Vol. XLV. November, 1926. New York: The Institute. Price $1.

" Television," by J. L. Baird. Pp. 62; 12 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. net.

Exhibitions of British Goods in Australia.—It is announced that two important exhibitions to demonstrate the manufacturing powers of Great Britain will be held in Melbourne and Sydney about a year hence.—*Reuter* (Melbourne).

One of these exhibitions, that at Melbourne, is apparently the one referred to by a correspondent in our last issue.

A European Aluminium Syndicate.—It was recently mentioned that negotiations were proceeding between certain makers of aluminium in Europe concerning operations in this industry, and it is now announced that a syndicate has been formed comprising most producers in Europe. The members are stated to be the German State-owned works embodied in the Ver. Aluminium werke, the Bitterfeld works owned by the Metal Bank and the dye trust, the Aluminium Industrie, A.G. of Neuhausen, the Aluminium Francaise and the British Aluminium Company, together with the Swedish works controlled by France and England, while the Norwegian works, which are closely associated with the Aluminium Company of America, remain outside the syndicate. The works in Austria are dominated by Swiss interests, while no great part is played by the Italian works which are only able to supply 40 per cent. of the inland requirements. The objects of the syndicate are to effect an interchange of experience and thus remove the veil of secrecy which has hitherto prevailed in this respect; to bring about an increase in sales and to stabilise prices, which were recently reduced by £13 per ton to encourage the consumption. Definite sales quotas for each country have not been fixed, although equalisation possibilities are provided should too great a difference take place between production and sales in any one of the participating countries. Certain possibilities of competition exist on the part of the Norwegian works, whose output is put at about 22,000 tons per annum. On the other hand the production of the other European works is computed at 88,000 tons, according to the statistics of the Metal Bank, while the American output last year is stated to have been 70,000 tons, of which 8,000 tons was produced by Canada and 62,000 tons by the United States. The statistics in question also give the production of France last year at 20,000 metric tons, Switzerland 22,000 tons, Germany 26,200 tons, German-Austria 3,000 tons, Great Britain 15,000 tons, Italy 1,800 tons, and Norway, as previously mentioned, 22,000 tons.

American Electrical Exports to Australia.—In a recent issue of *Commerce Reports* lists appeared of the exports of electrical goods from the United States to Australia during the past three years. The total values were as follows:—1923, $4,542,808; 1924, $5,237,398; and 1925, $5,103,700. The most important item in 1925 was radio apparatus, which was valued at $675,483 (in 1924 the value was $1,052,707). The value of switchboard panels exported to Australia was $571,194. Other large classes were storage batteries, $271,830, and domestic heating and cooking devices, $214,319. Commenting upon the statistics, our contemporary says:—" Our exports of this (electrical) equipment to Australia hold second place, and are only superseded by those of Great Britain, in all classes, except fans, in which the business is divided almost equally among Great Britain, Italy, and the United States, and in filament lamps, in which the Netherlands ranks second, and America third."

The Latin-American Electrical Market.—In a recent series of reports upon conditions in Latin-American countries, *Commerce Reports* says that the Chilean heavy electrical equipment business has improved, but the electrical appliance trade records a seasonal depression. In Brazil the development of broadcasting facilities has led to an increased demand for radio apparatus. On the other hand, there is no improvement in the demand for electrical equipment. Sales of electrical equipment in Mexico have been good on account of Government contracts. The tariff revision, generally speaking, has increased import duties on manufactured goods and reduced those on raw materials.

Swiss Finance. — There is being formed in Zurich the South American Electricity Co. with a share capital of 30,000,000 Swiss fr. This is composed to the extent of 10 millions of Argentine capital, five millions English and Italian, five millions of the Motor Columbus Company, and 10 millions subscribed by some Swiss banking institutes.

Lighting Restrictions.—The Government proposes to continue the restrictions upon lighting for a further month from the expiry of the existing Order.

A Pre-War German Contract.—The *Financial Times* reports that before the Anglo-German Mixed Arbitral Tribunal last week the Dunderland Iron Ore Co. claimed from the Fried. Krupp A.G., Magdeburg, the sum of £2,273 (and interest) alleged to have been paid in respect of a pre-war contract for electrical machinery which had not been fulfilled. For Messrs. Krupp it was urged that they had spent all, and more than all, the money sent by the claimants on account of the contract. The President said that the Court could not be satisfied with a mere statement on that point. It required to know what had become of the plant. Judgment was reserved.

Coal Products, &c., Exhibition.—On November 16th there was opened at Manchester a National Coal Products, Chemical and Engineering Exhibition under the patronage of the Manchester Section of the Society of Chemical Industry. Owing to the industrial conditions, the scope of the exhibition was considerably restricted, but nevertheless there were many features of interest among the exhibits. The Electroflo Meters Co., Ltd., showed its electrically-operated fluid flow meter for the measurement of low- and high-pressure gas, steam, water, oil, &c. An " Electroflo " boiler meter was also shown in actual operation in conjunction with a Spencer-Bonecourt boiler. The boiler control panel comprised a 15-in. diam. steam flow indicator and a CO_2 recorder, together with distant recorder and integrator for the boiler meter. There were also distance temperature indicators and recorders, pressure indicators and recorders, and low-pressure gas meters. Messrs. George Kent, Ltd., had a large range of meters, including the " Venturi " recorder for measuring feed-water condensate, &c., telerecorders, &c. The Lea Recorder Co., Ltd., exhibited its coal meters for chain-grate stokers and for measuring coal consumed in Lancashire boilers, the " Cubi-Meter," &c. Messrs. Negretti and Zambra had a number of interesting exhibits, including electrical distance thermometers and pyrometers of a fume- and dust-proof type, also electric alarm thermometers and hygrometers. Considerable space was devoted to purely scientific exhibits, and on the stand of the Department of Scientific and Industrial Research the " Gray-King " low-temperature carbonisation assay of coal was shown with an electrically-heated furnace, maintaining 600 deg. C. from a 220-V d.c. supply. The temperature control instrument was loaned by the Foster Instrument Co. The Thermal Syndicate, Ltd., showed a selection of pipes, &c., for the chemical industries, and also muffles, &c., for high-temperature gas and electric furnaces, protection sheaths and tubes for thermo-couples, X-ray and other apparatus, envelopes for high-power radio valves, special apparatus for optical and other research purposes, together with heatproof globes and bowls for gas and electric lighting. Messrs. G. & J. Weir, Ltd., exhibited a wide range of monel metal products. The Fusion Corporation, Ltd., of Middlewich exhibited samples of iron tubes and sheets made by the " Hutchins " electrolytic deposition process from wrought and cast iron, steel and scrap.

Other exhibitors included Messrs. Baird & Tatlock, Ltd. (electrical pyrometers), Messrs. T. Broadbent & Sons (centrifugals), Bolton's Superheater & Pipe Works, Ltd. (a new patent boiler-feed pump which utilises the waste heat of the exhaust steam to heat the feed water), Crosthwaite Engineering and Furnace Co., Filtrators, Ltd. (plant for the non-chemical treatment of boiler feed water, in which the action of the steam generates a colloidal emulsion), Messrs. Meldrums, Ltd., Messrs. W. & T. Avery, Ltd., and Spencer Bonecourt, Ltd. The exhibition will remain open until November 27th.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co., James & Shakespeare, and Edward Till & Co. report, November 23rd, no change in the prices for copper, English pig lead, and india rubber, Para fine.

For Sale.—Mr. H. J. Shaw will offer by auction on December 1st at 77, Chancery Lane, W.C.2, various trade stocks of wireless and electrical goods and materials. (See our advertisement pages to-day.)

Spain and Imported Machinery.—The Madrid correspondent of the Federation of British Industries says that General Primo de Rivera announces that a list is to be prepared of articles, the entry of which into Spain it is considered should be facilitated. Included in this list is heavy machinery, the national employment of which is relatively restricted, and in the manufacture of which Spain cannot pretend to compete with England, America, Germany, &c.

A Lamp Display Device.—For the use of retailers of its " Osram " lamps, the GENERAL ELECTRIC CO., LTD., is supplying at a small charge a lamp display rack. This has eleven lampholders, into each of which a lamp of a different type can be inserted, with a push-button switch for each lamp.

German Imports into New South Wales.—A list published in the *Board of Trade Journal* of German goods imported into New South Wales during August last includes the following:—Electrical appliances £1,065, and vacuum cleaners £1,570.

Polish Tariff Reductions.—Under the Polish-Czecho-Slovakian convention which came into force on November 6th, the duties upon steam boilers and turbines upon importation into Poland are reduced. The new rates are applicable to United Kingdom manufactures.

Polish Electrical Imports. — According to the *Board of Trade Journal*, Poland imported apparatus, conductors and other electro-technical materials to the value of 2,096,000 gold zloty during September.

Newcastle Contractors' Dinner.—The 26th annual dinner of the Newcastle branch of the Electrical Contractors' Association (Inc.) will be held at Tilley's Restaurant, Newcastle-on-Tyne, at 7 p.m. on Thursday, December 9th. The president of the Association will be present.

Exhibitors at Birmingham, 1927.—The name of MESSRS. SANTON, LTD., of Newport, Mon., should be added to our list of exhibitors who have booked space at the British Industries Fair, Birmingham. They will show various types of their Santon electric geysers and their switching and other plugs.

Electrical Imports of Bermuda.—The *Board of Trade Journal* states that Bermuda imported electrical goods valued at £25,863 during 1925.

Lighting and Power Notes.

Australia.—SYDNEY.—*Year's Working.*—We have received from Mr. S. Y. Maling, who has been acting as general manager and city electrical engineer during the absence of Mr. H. R. Forbes Mackay, a copy of his report, together with the statement of accounts on the working of the city electricity undertaking for the year ended December 31st last. The total revenue amounted to £1,700,454, as compared with £1,611,767 in the preceding year. Working expenses amounted to £1,045,704, as against £841,828, leaving a gross profit of £654,750 (£769,939). After deducting capital and other charges there was a net surplus of £53,608, as compared with £207,271 in 1925. The capital expenditure during the year amounted to £744,290, the chief items being £360,822 for mains work, including buildings, and £279,284 for sub-station plant, buildings, &c. The electrical energy generated amounted to 211,455,600 kWh. 41,902,570 kWh was purchased from the New South Wales Railway & Tramways Department. The sale of electrical energy increased from 188,425,931 to 202,424,951 kWh, and the maximum supply demanded from 60,080 to 71,380 kW. The average price obtained per kWh fell from 1.946d. to 1.915d. During the year the Council notified the Railways and Tramways Department of its intention to terminate its agreement for the purchase of electricity from the Department at the end of 1930, and decided to erect a new power station at Botany which will be capable of an output of 300,000 kW. The first instalment will be able to meet a demand of 100,000 kW. Totals of 72 miles of h.p. mains, 87 miles of l.p. mains, and 123 miles of street lighting mains were put into service during the year.

Ayrshire.—SPECIAL ORDER.—The Ayrshire Electricity Board is to consider, at a meeting on December 3rd, a proposal that application be made for a Special Order authorising it to supply electricity in the burghs of Girvan, Maybole, and Largs.

Barnes.—NEW PLANT.—The Urban District Council proposes to install an additional 1,000-kW rotary converter and one 1,100-kVA transformer, and application is to be made for sanction to a loan of £4,000 to cover the cost of the new plant.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Gatineau Power Company, subsidiary of the Canadian International Paper Company, has commenced the development of the Paugan Falls site on the Gatineau River north of Ottawa. The primary development is stated to be 200,000 h.p. This is the third large development which this company has put in hand on the Gatineau River during the year. The Chelsea plant will be ready to deliver power by about January 1st next. Construction of this large plant, which will develop 170,000 h.p., was started in November, 1925. The Farmers' Rapids plant should be ready for operation by March 1st, 1927. This plant will develop 120,000 h.p.

Continental.—AUSTRIA.—According to a recent return, the hydro-electric development at the end of last year amounted to approximately 456,000 h.p., the annual production being equal to approximately 2,600 million kWh, while new plant is in course of erection that will increase the output by a further 760 million kWh. One of the largest new hydro-electric plants completed during the past year was that at Partenstein for the Upper Austrian Water Power and Electricity Co. The plant has a capacity of 38,000 h.p., and the electricity generated is being transmitted at 110,000 V to Vienna, a distance of 134 miles.

BELGIUM.—The report of the Société Intercommunale Belge d'Electricité, of Brussels, for the year ended June 30th last states that further progress has been made with the inter-connection of the company's eight power stations in order to meet any sudden increase in the demand for the supply in the respective areas and also to maintain supply in the event of breakdown at any one plant. The various stations have now an aggregate capacity of 215,200 kVA, and additional plant is being installed which will increase this to 245,500 kVA. A new 8,200-kVA turbo-generator was completed at Paturages, a new turbo-alternator set of 15,500 kVA was completed at Malines, while at Alost a new 17,500-h.p. set is in course of erection. Boilers employing pulverised fuel firing are being installed at three stations. The company, in conjunction with affiliated concerns, is now supplying electricity to 316 localities, which has necessitated the laying of about 500 miles of mains, bringing the total up to nearly 4,100 miles.

Epsom.—ELECTRICITY CHARGES.—The Urban District Council has adopted the following new scale of charges for electricity:—Flat rate, domestic and business premises: Lighting, 8d. per kWh; heating, 3d. per kWh. All-in rate: Business premises, a fixed quarterly charge of 3s. for each 50 W installed for lighting purposes only, plus 1½d. per kWh. Prepayment meters: Flat rate of 8d. per kWh.

HIRE OF DOMESTIC APPLIANCES.—The Council proposes to hire out electric cooking apparatus and other domestic appliances the wiring, &c., to be carried out by approved electrical contractors, and a loan of £2,000 for the purchase of apparatus has been applied for. The Council has also decided to undertake the wiring of domestic premises for lighting, heating, and power.

Gravesend.—YEAR'S WORKING.—The combined accounts of the Gravesend and Northfleet municipal electricity undertakings (engineer, Mr. C. F. McInnes) for the year ended March 31st last, show a total income of £69,793, as compared with £62,025 in the preceding year. The working expenditure amounted to £33,612 (as against £35,938) and after providing for bad and doubtful debts there was a gross profit of £32,964 (£26,087). To this was added £8,857 brought forward, and other sums making £41,844, and the total charges were £27,213, leaving £14,631 to be carried forward. The appropriations included £3,857 for capital purposes, £4,000 for the borough rate, £500 for the reserve fund, and £500 for the assisted wiring scheme. The capital expenditure during the year amounted to £47,684, making the total £301,509. The principal items were machinery (£26,783), buildings (£8,345), and mains (£7,957). The amount of energy sold rose from 9,238,035 to 11,407,681 kWh, and the maximum demand from 3,500 to 4,700 kW. The working costs fell from 0.86d. to 0.675d. The consumption per head was 250 kWh, against the average for the country of 110 kWh. The engineer says that central offices and showrooms are essential and recommends the setting aside of a substantial sum for the purpose. The installation of new plant is rapidly nearing completion, although labour troubles have caused delay.

London.—SHOREDITCH.—The Housing Committee has recommended that the offer of the Lighting Committee to install electric cookers in the tenements at Britannia, Provost, Citizen, and Council dwellings, and electric heaters in bedrooms at St. Leonard's dwellings be accepted. The charge for cooking to the tenants will be 1½d. per kWh, including the hire of cookers and kettles.

Lossiemouth.—NEW PLANT.—The Lossiemouth Town Council has approved the proposal of the Lighting Committee to install new plant at the electricity station. The additions include a new crude oil engine and 60-kW generator. It was also agreed that one of the existing 25-kW sets should be thoroughly overhauled. An all-round reduction of 10 per cent. in the price of electricity was approved.

Paignton.—PURCHASE OF UNDERTAKING.—At a recent meeting of the Urban District Council a communication was received from the Paignton Electric Light & Power Co., Ltd., asking if the Council would agree to postpone the date of purchase of the electricity undertaking until 1937, if the company would agree to provide at an early date such further extensions of cable and facilities as might reasonably be required. The Council has replied that it is unable to postpone the date of acquisition.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

SHOREDITCH.—Heating and cooking: An increase of 25 per cent.

WAKEFIELD.—An increase of 15 per cent.

WHITEHAVEN.—Lighting, heating and power: An increase of ¼d. per kWh.

GUERNSEY.—*The Guernsey Electric Light & Power Co., Ltd.*—An increase of 10 per cent.

SALFORD.—An increase of ¼d. per kWh.

ISLINGTON.—An increase of 10 per cent.

PERTH.—An increase of 20 per cent.

GLASGOW.—An additional increase of 10 per cent.

Pudsey.—LOAN.—The Corporation is applying for sanction to a loan of £10,000 for the laying of cables in the main streets of the town. A new switchboard has been installed at the power station.

Rhuddlan.—STREET LIGHTING.—An electricity supply for street lighting was formally inaugurated on November 6th. Electricity is supplied from the North Wales Power Co.'s works at Dolgarrog and distributed by the Electrical Distribution of North Wales and District, Ltd.

Southend-on-Sea.—INQUIRY.—The Electricity Commissioners will resume their inquiry into the Corporation's electricity undertaking on November 30th.

Southport.—UNEMPLOYMENT RELIEF SCHEME.—Included in the schemes proposed to be undertaken by the Corporation for unemployment relief, is one for the laying of a cable from the electricity works to Ainsdale, at an estimated cost of £25,000.

Special Orders.—Application has been made to the Electricity Commissioners for Special Orders by the Dawlish Electric Light and Power Co., Ltd., authorising it to supply electricity in certain parishes in the rural districts of St. Thomas and Newton Abbot; and the Amesbury Electric Light and General Supply Co., Ltd., to supply in the rural district of Amesbury.

Torquay.—LOANS.—The Corporation Electricity Committee is applying for sanction to the following loans:—Additional h.p. and l.p. mains, £9,620; additional plant for the Upton Valley sub-station, £1,427; mains and services, £12,500.

Tynemouth.—WIRING OF SMALL HOUSES.—The Corporation Electricity Committee has voted a further £5,000 for its assisted wiring scheme.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, of the 3,866,000 h p. which has been placed under licence since the enactment of the Water Power Act in 1920, nearly 40 per cent. was put under construction during the last fiscal year. The projects licensed during the year and their ultimate installations are as follows: Susquehanna Power Co. and Philadelphia Electric Power Co., Susquehanna River, 473,000 h.p.; Alabama Power Co., Coosa River, 180,000 h.p.; Nevada Irrigation District, Yuba River, 150,000 h.p.; Louisville Hydro-Electric Co., Ohio River, 135,000 h.p.; Mt. Shasta Power Co., Pitt River, No. 4, 100,000 h.p.; San Joaquin Light and Power Co., Kings River, 65,000 h.p.; Feather River Power Co., Feather River, 60,000 h.p.; Pacific Gas & Electric Co., Mokelumne River, 42,000 h.p.; various small projects 15,000 h.p.

The Gulf States Utilities Co. has announced the completion of the first section of a new power station on the Neches River at Beaumont, Tex., at total cost of $3,500,000. This station, the ultimate capacity of which is to be 300,000 kW, will supply electricity in south-eastern Texas and southern Louisiana.

Weardale.—ELECTRICITY SUPPLY.—The Rural District Council is considering a scheme to supply electricity throughout Weardale, from Wolsingham to Cowshill, at a cost of £30,000, and an application is to be made for powers to proceed. The clerk reported that a canvass of the district had resulted in the names of 1,054 prospective customers being secured, from whom an annual revenue of £7,418 was expected.

West Midlands Joint Electricity Authority.—At the meeting of the Authority held on November 5th, a report of the General and Finance Committee covering a scheme of purchase and adaptation of an existing building in Wolverhampton at an estimated expenditure of £10,210 was approved. It was resolved to continue the proceedings for obtaining an Order for the compulsory acquisition of the land required at Ironbridge for the new base load generating station. The Authority also approved of the extension scheme of the Birchills generating station at an estimated cost of £212,438.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—The Budget of the Federal Railway Authority for 1927 provides a sum of £3,520,000 for new extensions. As in recent years the bulk of this sum is earmarked for further electrification work which, during the coming year, will be mainly centred in Eastern Switzerland. A sum of £160,000 is allocated for the extension of the Vernayaz hydro-electric station, and £280,000 for the construction of additional transformer stations.

ITALY.—The Government has given instructions for work to begin on the enlargement of the central electric station at Morbengo, which provides power for the electrified Monza-Lecco line. The station will provide electricity for other lines near Milan, including the main line Voghera-Milan-Chiasse. Upon both the French and the Swiss sides an extensive network of electrified lines will be brought into combined operation. The cost of the power station is estimated at 25,000,000 lire.—*Reuter's Trade Service* (Milan).

Darlington.—PROVISIONAL ORDER.—The Corporation has applied to the Minister of Transport for a Provisional Order authorising it to introduce railless-car services on a number of new routes.

Sheffield.—PROVISIONAL ORDER.—The City Council has applied to the Minister of Transport for a Provisional Order authorising the construction of new tramways.

Hastings.—RAILLESS CARS.—Negotiations are proceeding between the Hastings and District Electric Tramways Co., Ltd., and the Corporation for the substitution by the company of railless cars for the present tramway system. The question of the payment of wayleaves has been settled, but the cost of the reinstatement of the roads is still under consideration. The company is to promote a Parliamentary Bill authorising it to carry out the proposed scheme.

London.—NEW CARS.—The London United Tramways has now introduced four new cars of the saloon type on the Hounslow to Hampton Court routes. There are now 33 of these cars in service, and this number is to be increased to 40. The principal improvements include cross seats upholstered in moquette, a rubber floor, and improved lighting.

THROUGH-RUNNING.—The Highways Committee of the L.C.C. has recommended that the agreement between the Council and Walthamstow Urban District Council for the through-running of L.C.C. cars between Liverpool Street and Chingford Mount be extended from January 23rd to April 23rd next.

GOLDER'S GREEN STATION.—The present booking offices at Golder's Green Tube station are to be demolished and passimeter booking booths erected. The number of passengers using this station is about 40,000 a day.

Maidstone.—PROVISIONAL ORDER.—The Corporation has applied to the Minister of Transport for a Provisional Order authorising it to introduce a railless-car service on certain routes in the town.

Plymouth.—NEW CARS.—The Corporation Tramways and Transport Committee has decided to provide 15 new tramcars to replace a number of cars which have been in service for over 20 years.

Rotherham.—RAILLESS CARS.—The Borough Council is to apply for a Provisional Order for the purpose of co-operating with the Mexborough and Swinton Tramways Co. in a railless-car scheme. The company desires to obtain powers to run cars into Rotherham. It was stated at a recent meeting of the Council that the company was scrapping plant valued at £100,000 and installing railless vehicles at a cost of £60,000. The cost to the Council is estimated at £8,000.

Stoke.—PURCHASE SCHEME REJECTED.—The Corporation has decided not to proceed with negotiations for the purchase of the undertaking of the Potteries Electric Traction Co., Ltd.

Telegraph and Telephone Notes.

Australia.—NEW SOUTH WALES.—According to the *Sydney Morning Herald*, Mr. N. P. Brown, secretary to the Postmaster-General's Department, recently stated that the telephone was becoming an increasingly important item in the development of country districts. Last year the Department lost £275,000 on country telephone services, and this year it might amount to £300,000, but the value of the services to people living in rural districts was immeasurable, and it was the Government's intention to continue the policy of decentralisation. He announced that important alterations and additions would shortly be made to the Goulburn post office, which, he said, had become a most important centre for telephone and telegraph business. Equipment to amplify the current for all the long-distance southern trunk calls, which come through Goulburn, will be installed here. Six new branches are to be formed, the other five being in Newcastle, Lismore, Wagga, Dubbo, and Armidale. The Goulburn station will be equipped with apparatus to amplify and relay the new telegraph system by means of carrier wave wireless, the wave-length being greater than that used by broadcasting stations. At present 10 different telegraph messages can be sent at the same time over one wire, which is also used at the same time for telephone messages. The improvements will enable this number to be increased. A special teletype machine will be used for the reception of messages. The Department has been for some considerable time considering the zone system of charging for telegrams, though so far no definite decision has been arrived at. The loss on the direct mileage system of telephone calls was £100,000 last year. The wages paid by the Department amounted to £500,000 more last year than previously.

Belgium.—TELEGRAPHS AND TELEPHONES.—It is reported that the National Telegraph and Telephone Co., which the Government has been thinking of establishing on the model of the National Railway Co., will not be set up. A scheme is now contemplated for setting the telegraph and telephone systems on an independent basis both in respect of finance and control, thus putting matters on a business footing and permitting loans to be contracted, secured on the plant of the undertaking.—*Reuter* (Brussels).

Burma.—WIRELESS TELEPHONY.—*The Times* reports that the first system of wireless telephony in Burma has been established between the office of the Rangoon Port Trust and the pilot vessel in the Gulf of Martaban. The telephone has a device by which either party can call up, and is capable of communicating with vessels for a distance of 200 miles.

New Pacific Cable.—The Sydney correspondent of the *Daily Telegraph* reports that the cable ship *Faraday* on November 20th, at Suva (Fiji Islands), spliced the ends of the new duplicated section of the Pacific cable from Fanning Island to Suva, a distance of 2,043 miles. The vessel started her journey from Fanning Island on November 1st. It was expected that the *Dominia* would complete on November 22nd at Fanning Island the splicing of the northern section of the cable from Bamfield (British Columbia) to Fanning Island, 3,048 miles, the largest single cable in the world. These new sections, which are of the "loaded" type, are guaranteed to work at 700 letters per minute simplex, as compared with the present 135 letters duplex. The speed will probably be greater, as 900 letters simplex are expected. If duplex working is effected, as is anticipated, the capacity will be doubled. The contract price for the Bamfield-Fanning section with the Telegraph and Construction Maintenance Company was £1,607,000, and that for the Fanning-Suva section with Siemens Bros. was £716,900. With the Southern sections duplicated in 1923, the total cost of the duplication is about £2,800,000, as compared with under £2,000,000 for the original cable. The whole cost of the duplication will be met from profits. Commercial communication will not be effected for a month, as the contractors will test during that period.

The Telephone Service.—COMPLETION OF EXCHANGE CHAIN.—It has taken 50 years to provide a telephone exchange for every county in Great Britain and Ireland, but with the provision of exchanges in County Mayo (Ballyhannis) and Sutherlandshire (Dornoch) the chain is now complete.

COVENTRY.—The change-over to the automatic system of telephony was successfully effected in Coventry on November 20th.

United States.—RECORD CALL.—Five hours and a quarter of continuous talking over a distance of 3,180 miles is the world's record telephone call. It was made recently by a special conference of the American Federation of Musicians in New York to San Francisco. The conversation continued for 315 minutes, at a cost of about £430. No intimation was given that the call was likely to last longer than the usual three minutes. The call resulted in the settlement of a dispute that threatened to lead to a general strike in the theatres of the Orpheum Circuit throughout the West.

Radio Notes.

Australia.—MELBOURNE.—According to the *Electrical Engineer of Australia and New Zealand*, the Associated Radio Co., which operates broadcasting station 3AR, Melbourne, reports a net profit of £3,774 on its operations for the year ended June 30th, 1926. This was obtained after a drastic writing down of stock values, providing for contingencies and writing off £452 for depreciation. The company has had an anxious time during the few years of its existence, but the future is distinctly brighter. In accordance with the recommendations of the consulting engineer, Mr. Donald Macdonald, it is proposed to install a new transmitter of about 5-kW capacity and to make general improvements to the studio, programmes, and general broadcasting.

LICENCES.—During the month of September the number of broadcast radio receiving licences issued in the Commonwealth was 19,530, making the total in force 165,436, of which 44,962 and 83,077 were accounted for by New South Wales and Victoria respectively.

France.—NEW BROADCASTING STATION.—It is reported that a new broadcasting station is to be constructed in Paris. The report states that the station will be more powerful than the station at Daventry or the new 50-kW station which is being erected in Germany.

Peru.—BROADCASTING.—The Government has cancelled the radio monopoly in Peru, and it will now be possible to import and sell radio apparatus without any restrictions. The broadcasting operations have been entrusted to the Marconi Co. for the account of the Administration. The licence fee for each receiving set is £P1.—*Reuter's Trade Service* (Lima).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

January 18th, 1927. Switchboard cable. (B.X. 3013.)*

January 25th, 1927. Telephone transmitters and parts. (B.X. 3012.)*

Telephone receivers and associated parts. (B.X. 3041.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). (A.X. 3810.)*

Belfast.—December 11th. Electricity Department. Penstocks for circulating-water channels and ducts at Harbour power station. (See this issue.)

Belgium.—December 8th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Supply and laying of a quantity of telephone cables in the Antwerp district. Particulars (Cahier des Charges Special No. 3—237) for 8 fr. 10 centimes.

December 4th. Municipal authorities of Ghent. Six electric cranes. Particulars (Cahier des Charges No. 1,580) from Hotel de Ville.

Cleethorpes.—December 11th. Electricity Department. E.h.p. feeder and l.p. distributor cables, section pillars, and disconnecting boxes, transformers and switchgear equipment, and house services, including meters. (November 19th.)

Dublin.—December 9th. Great Southern Railway Co. Six months' supply of electric cables, electric lamps, &c. Forms of tender (6d. each) from the Stores Superintendent, G.S. Railways, Inchicore, Dublin.

Egypt.—CAIRO.—December 5th. Ministry of the Interior. Electric motors and accessories. (B.X. 2996.)*

Ministry of Education. December 16th. Five a.c. motors and switchboard for Assiout model workshops. (B.X. 3016.)*

Erith.—November 30th. Electricity Department. L.p. cables. (November 19th.)

Haddington.—December 11th. East Lothian Education Authority. Electric lighting of new infants' school at Tranent. Schedules from Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

Hastings.—November 30th. Corporation. Two sets of electrically-driven turbine or centrifugal deepwell pumps, with all electrical equipment, &c. (November 5th.)

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)

January 4th, 1927. 264,650 (approx.) copper bonds for track rails. (See this issue.)

December 7th. Madras and Southern Mahratta Railway Co., Ltd. Sixteen 35-b.h.p. short-circuited rotor motors and two 10-b.h.p. ditto, complete with pulleys, slide rails, starting switches, &c. (November 19th.)

London.—LAMBETH.—December 7th. Board of Guardians. Twelve months' supply of incandescent electric lamps. (See this issue.)

Manchester.—December 3rd. Electricity Committee. One steam shunting locomotive. (See this issue.)

January 3rd, 1927. 33,000-V, 420-V, and 240-V switchgear. (See this issue.)

Meltham (near Huddersfield).—December 31st. Wiring, fittings, &c., required in the electric lighting of the Parish Church. Particulars from Mr. W. R. Carter, secretary, Church Council, Birchfield, Meltham.

New Zealand.—WELLINGTON.—January 4th, 1927. Public Works Department. Waikaremoana electric power scheme. Switchgear and transformers. (B.X. 2872.)* January 18th, 1927. Transmission line steel towers. (A.X. 3732.)* February 1st, 1927. Storage battery and booster. (B.X. 2937.)*

February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*

Post and Telegraph Department. January 17th, 1927. Switchgear, cables, motor-generator sets, &c. (B.X. 3020.)*

January 19th, 1927. Electric bells and tumbler switches. (B.X. 3011.)*

January 31st, 1927. Government Railways. Electrical equipment for Otahuhu car and wagon workshops. (B.X. 3038.)*

Nottingham.—December 31st. Electricity Department. Two 30-in. electrically-driven pumps, one motor-driven twin booster, one 256-cell storage battery. (November 19th.)

Oxford.—December 8th. Oxford Electric Co., Ltd. One 7,500-kW turbo-alternator, with condensing plant and auxiliaries. (November 19th.)

Portsmouth.—Electricity Department. Two 50,000-lb.-per-hour water-tube boilers, with economisers, steel bunker, and steel building. (See this issue.)

Prestatyn.—December 6th. Urban District Council. Underground cables, overhead lines, transformers, e.h.p. and l.p. switchgear, and sub-station equipment. (November 12th.)

Siam.—December 15th. Royal Siamese Post and Telegraph Department. Telephone and submarine cable. (B.X. 3026.)*

South Africa.—KEETMANSTROOP.—December 15th. Municipal Council. Material required for an electric lighting scheme. (B.X. 3007.)*

JOHANNESBURG.—December 11th. Municipal Council. H.p. cable. (B.X. 3017.)*

CAPE TOWN.—December 15th. Electricity Department. Oil-cooled transformers. (B.X. 3028.)*

December 30th. South African Railways. Switchgear, cables, and transformers. (B.X. 3040.)*

Sutton Coldfield.—December 14th. Electricity Department. One 1,000-kW steam turbine, with condensing plant, auxiliaries, and piping. (November 12th.)

Uruguay.—MONTEVIDEO.—January 19th, 1927. State Electricity Supply Works. 100,500 metres of wires and cables. (B.X. 3042.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Electricity Supply Committee.
Two electrically-driven turbine pumps (£5,116).—Thompson's Engineering and Pipe Co., Ltd.
—*Tenders.*

Town Hall and Baths Committee.—The Committee has decided to withdraw its recommendation to accept the tender of the British General Electric Co., Ltd., at £5,883, for electric lighting fittings for the Town Hall (see ELEC. REV., November 12th, p. 800), and is calling for fresh tenders closing on January 4th. The total cost of the fittings is not to exceed £5,000.

Dorchester.—Electricity Committee. Accepted:—
Supplying and laying cables (£1,833).—Johnson & Phillips, Ltd.

Dumfries.—Town Council. Accepted:—
Installing electric light in 98 houses (£22 and £23 18s. per block).—Mr. John Marshall.

L.M. & S. Railway.—The Harland Engineering Co., Ltd., has received an order from the London, Midland, and Scottish Railway Co. for three rotary-convertor equipments required for the Carron Dock sub-station at Grangemouth. Each equipment will comprise a 150-kW rotary convertor, transformers, and starting gear, and will be used for operating the dock cranes at Grangemouth. The rotary convertors will be manufactured at the Harland Company's heavy plant and machinery works at Alloa, Scotland.

Government Contracts.—The following contracts were placed by Government departments during October :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Motor alternators.—Newton Bros. (Derby), Ltd.; W. Mackie & Co., Ltd.
Batteries.—D.P. Battery Co., Ltd.; Chloride Electrical Storage Co., Ltd.
Electric bells.—A. Graham & Co.; W. McGeoch & Co., Ltd.
Junction boxes, &c.—Engineering and Lighting Equipment Co., Ltd.; Hawkers, Ltd.; Pinnacle Switchgear, Ltd.
Multicore lead-covered cables.—Johnson & Phillips, Ltd.
Electrically-driven capstans.—Cowans, Sheldon & Co., Ltd.
Coils.—H. W. Sullivan, Ltd.
Air compressors.—Fullerton, Hodgart & Barclay, Ltd.; Reavell & Co., Ltd.
Electric drive for planing machine.—Stothert & Pitt, Ltd.
Electric lighting fittings.—General Electric Co., Ltd.; Engineering and Lighting Equipment Co., Ltd.; W. McGeoch & Co., Ltd.; Player and Mitchell; Dugdill & Co., Ltd.; Dorman & Smith, Ltd.
W/t frameworks.—Park Royal Engineering Co., Ltd.
Electric furnace.—Electric Furnace Co., Ltd.
Motors.—Harding, Churton & Co.
Note magnifiers and tuners.—Radio Instruments, Ltd.
Transformers.—British Thomson-Houston Co., Ltd.; Foster Engineering Co., Ltd.; Ferranti, Ltd.; English Electric Co., Ltd.
W/t valves.—Mullard Radio Valve Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Electrically-driven winches.—Harfield & Co., Ltd.

WAR OFFICE.

Electric cable.—Callender's Cable and Construction Co., Ltd.; British Insulated Cables, Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Battery cases.—Barrow, Hepburn & Gale, Ltd.
Lamp cases.—C. F. Timbers.
Generating sets, spares.—Douglas Motors, Ltd.
1,000-kW turbo-alternator.—Richardsons, Westgarth & Co., Ltd.
Electric lighting installation, Richmond Barracks.—Gray Bros. (Newcastle), Ltd.

AIR MINISTRY.

Generating sets (Hinaidi).—Vickers-Petters, Ltd.
Semi-Diesel oil engines.—Babcock & Wilcox, Ltd.
Underground mains (North Weald).—Malcolm & Allan, Ltd.
Generator clutches.—G. E. Mortley, Sprague & Co., Ltd.
Control resistance and voltmeters.—British Radio Corporation, Ltd.
Generators.—W. Mackie & Co., Ltd.; G. E. Mortley, Sprague & Co., Ltd.; Small Electric Motors, Ltd.
Modified t.f. receivers.—Siemens Bros. & Co., Ltd.

POST OFFICE.

Telephone exchange equipment.—Blackburn: Automatic Telephone Mfg. Co., Ltd. Willesden: General Electric Co., Ltd. Cambridge, Bradford, Reigate, Palmers Green, and Sevenoaks: Standard Telephones and Cables, Ltd. Bury Corporation, Greenock Corporation, Earl of Dudley's Round Oak Works, Ltd. (Staffs.), Moss Gear Co., Ltd. (Birmingham): Relay Automatic Telephone Co., Ltd. Museum: Ericsson Telephones, Ltd.
Telephone repeater station (2 wire equipment).—Canterbury: General Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Standard Telephones and Cables, Ltd.
Testing, protective and miscellaneous apparatus.—Phœnix Telephone and Electric Works, Ltd.; T. Watson.
Wireless apparatus.—Standard Telephones and Cables, Ltd.
Battery stores.—C. A. Vandervell & Co., Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Cable (various).—Callender's Cable and Construction Co., Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works, Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Telephone cords.—British Insulated Cables, Ltd.; Siemens Bros. & Co., Ltd.
Ducts.—Hepworth Iron Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.; Guest, Keen & Nettlefold, Ltd.; Wilkes, Ltd.
Earth plates.—Baldwins, Ltd.
Electric light switches.—H. Ingledon & Co., Ltd.
Cadmium copper wire.—R. Johnson & Nephew, Ltd.; F. Smith & Co., (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Switchboard wire.—General Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Switchgear.—British Thomson-Houston Co., Ltd.; Ferguson, Pailin, Ltd.
Telegraph line materials.—J. Spencer, Ltd.
Telephone materials.—Ericsson Telephones, Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
Transmitter valves, &c.—Marconi's Wireless Telegraph Co., Ltd.
Wire.—Siemens Bros. & Co., Ltd.; G. Christie, Ltd.; R. Johnson, Clapham & Morris, Ltd.; Shropshire Iron Co., Ltd.; Elliott's Metal Co., Ltd.
Wireless apparatus.—Radio Communication Co., Ltd.

H.M. OFFICE OF WORKS.

Teddington Laboratory (storage battery).—D.P. Battery Co., Ltd.

London. — HACKNEY. — Electricity Committee. Recommended :—

Two 1,000-kW Peebles-La Cour motor convertors arranged for manual and remote-control operation (£6,970); two series-wound mid-wire boosters (£300).—Bruce Peebles & Co., Ltd.

ST. PANCRAS.—Electricity Committee. Recommended :—

L.p. cable (£4,291).—Standard Telephones and Cables, Ltd.

ST. MARYLEBONE.—Electricity Committee. Accepted :—

Transformers and switchgear, &c., in connection with the supply of electricity to the Zoological Society, Regent's Park :—Transformer group.—British Electric Transformer Co., Ltd. Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.

Manchester.—Tramways Committee.

Permanent-way special trackwork.—The Titan Trackwork Co.; Edgar Allen & Co., Ltd.; Hadfields, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted :—

3½ tons copper wire (£290).—British Insulated Cables, Ltd.
Two machine control panels (£400).—Metropolitan-Vickers Electrical Co., Ltd.
2,000 20 watt colour-sprayed vacuum-type lamps (£161).—British General Electric Co., Ltd.
Spares for 7,500-kW machines (£7,377).—Metropolitan-Vickers Electrical Co., Ltd.
30in. flambeau brackets (£797). "Novalux" street-lighting fittings (£697), S.A. General Electric Co.
8,000 100-watt, 220 volt metallic-filament lamps (£733).—Auto Electric Supply (Cape), Ltd.
Cable (£11,295).—British Insulated Cables, Ltd.

Forthcoming Events.

Physical Society of London.—Friday, November 26th. Imperial College of Science, S.W. 5 p.m. Ordinary scientific meeting.

Royal Institution.—Saturday, November 27th. 21, Albemarle Street, W. 3 p.m. "Atmospheric Electricity." Mr. G. C. Simpson.

Tuesday, November 30th. 5.15 p.m. "The Imperfect Crystallisation of Common Things." Sir William Bragg.

Batti-Wallahs' Society.—Monday, November 29th. Westminster Palace Rooms. Ball.

Institution of Welding Engineers.—Monday, November 29th. Caxton Hall, S.W. 8 p.m. "Thermal Disturbance in Iron and Steel During Welding." Mr. J. H. Paterson.

Royal Society of Arts.—Monday, November 29th. 8 p.m. "Recent Experiments on the Properties of Steam at High Pressure," by Prof. H. L. Callendar, F.R.S.

Wednesday, December 1st. 8 p.m. "The Torque Convertor." Mr. G. Constantinesco.

Institution of Civil Engineers.—Tuesday, November 30th. London. 6 p.m. "The Mechanical Parts of Large Winding Engines." Messrs. P. R. Roberts and A. C. Anderson.

Edinburgh Electrical Society.—Thursday, December 2nd. 8 p.m. "Paper Making from the Electrical Engineers' View." Mr. R. G. Sands.

Institution of Electrical Engineers.—Thursday, December 2nd. London. "An Outline of the Trunking Aspect of Automatic Telephones." Mr. G. F. O'dell.

(Wireless Section).—Wednesday, December 1st. London. "Notes on the Design Details of a High-Power Radio Transmitter using Thermionic Valves." Messrs. R. V. Hansford and H. Faulkner.

(North Midland Centre).—Tuesday, November 30th. Leeds. 7 p.m. Ordinary meeting.

(North Western Centre).—Tuesday, November 30th. Engineers' Club, Manchester. 7 p.m. Ordinary meeting.

(Scottish Centre).—Tuesday, November 30th. Grosvenor Restaurant, Glasgow. 6 p.m. Annual dinner.

(South Midland Centre).—Friday, November 26th. Grand Hotel, Birmingham. Annual dinner.

Wednesday, December 1st. University, Birmingham. 7 p.m. "The Applications of Electricity to Agriculture," Dr. A. Ekstrom, and "American Agriculture and Farm House Electrification," Mr. J. W. Beauchamp.

(London Students' Section).—Friday, November 26th. 6.15 p.m. "The Measurement of Light." Mr. H. J. D. Palfrey.

Electrical Trades Commercial Travellers' Association.—Friday, December 3rd. Victoria House, Leicester Square, W.C.2. 7.30 p.m. Carnival dance.

Junior Institution of Engineers.—Friday, December 3rd. Royal Society of Arts. 7.30 p.m. "The Progress of Marine Engineering," by the President, Engineer Vice-Admiral Sir R. B. Dixon.

Nottingham Society of Engineers.—Friday, December 3rd. Victoria Station Hotel. Annual dinner.

Institution of Fuel Economy Engineers.—Friday, December 3rd. Royal Society of Arts. 6 p.m. "The Loss of Heat from a Surface by Radiation and Convection," by Dr. T. Barratt.

Electrical Power Engineers' Association (Southern Division).—Friday, December 3rd. Institution of Electrical Engineers, London. 7 p.m. "Choice of Turbine Plant." Mr. C. H. Naylor.

(West Yorks. Section).—Saturday, December 4th. Hotel Metropole, Leeds. Annual dinner.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 4th. Cardiff. 6 p.m. "General Colliery Engineering." Mr. W. G. Hardie.

Notes.

Electric Detonator Order.—A new type of detonator, having an aluminium capsule, has been introduced and used at a few quarries and metalliferous mines for shot-firing, and it has been found that, on the explosion of an aluminium detonator, the metallic particles of the aluminium of the capsule at an extremely high temperature may initiate an explosion of inflammable gas or coal dust. The Secretary for Mines, after consultation with the Explosives in Mines Research Committee, has accordingly taken the precautionary step of making an Order under Section 61 of the Coal Mines Act, 1911, to the effect that no detonator other than an electric detonator in a copper capsule may be used in coal mines in which the use of "permitted explosives" is compulsory under the Explosives in Coal Mines Order of September 1st, 1913. No objection is raised in any way to the use of aluminium-cased detonators in other mines or generally at quarries.

Electricity Supply Company and a Rented Installation.—At the St. Austell (Cornwall) County Court on November 15th, Judge Gurdon resumed and again adjourned the hearing of an action by the St. Austell Electric Light & Power Co., Ltd., against the tenant and owner of a house in which the company had installed electric light and in respect of which it claimed rent against the tenant and the ownership of the installation against the owner. The property had been sold and the new owner and tenant repudiated the company's claim, the former alleging that the electrical installation was included when he purchased the house. The tenant had paid rent to the company subsequently, but claimed that he did so under a misapprehension.

New German Insulating Material.—The Glisoma-Werke Schierstein on the Rhine, formerly known as Landsberg and Ollendorf, of Frankfort, is manufacturing a new insulating material known under the trade name of "Peralit." The new product is intended to replace fibre, hard rubber, and other insulating materials. It is built up of layers of certain materials, the nature of which is not reported, and subjected to very high pressure with application of heat. The insulating material has a high electrical resistance, and is said to keep its shape up to 200 deg. C. It is not affected by oil, air or humidity, and is only affected by certain acids.—*Commerce Reports.*

A 160,000-kW Turbo-generator Set.—Some additional particulars are now available with respect to the 160,000-kW turbo-generator set which the United Electric Light & Power Co. of New York recently ordered from the Brown-Boveri Electric Corporation for its Hell Gate power station. The set has been designed on the cross-compound plan and comprises a h.p. turbine running at 1,800 r.p.m. and coupled to a 75,000-kW three-phase alternator and a two-stage l.p. turbine driving an 85,000-kW alternator at 1,200 r.p.m. The initial steam will be at a temperature of 322 deg. C. The set, which will occupy an area of 67¼ ft. by 39½ ft., will, it is claimed, be the largest in the world. The 75,000-kW machine will have only four poles, whereas the largest generator hitherto made, of 60,000-kVA capacity, has six poles.

Colour Code for Motor-car Wiring.—With the object of simplifying the identification of the various wires used in the electrical systems of motor vehicles in maintenance and service stations, a sub-division of the Standards Committtee of the American Society of Automotive Engineers has recently proposed a colour code to be used for the covering material of electrical cables. The unprotected live wires would be coloured and the protected ones yellow. The proposal is being submitted to the electrical equipment divisions of the Standards Committee. If approved it will next be considered by the Standards Committee as a whole and finally by the Council of the Society.

Appointments Vacant.—Electrical engineer for the Indian State Railways. Assistant divisional telegraph engineer for the Government of India Posts and Telegraphs Department. Head of the Electrical Engineering Department of the St. Helens Municipal Technical School. Shift engineer (£254) for the Borough of Eccles Electricity Department. Plumber-jointer for Watford Corporation Electricity Department; mains assistant for Torquay Corporation Electricity Undertaking. (See our advertisement pages to-day.)

Diesel-Electric Locomotive Construction in Russia.—The Commissariat of Ways and Communications some time ago requested the Glavmetall to use its influence with the engineering works to accept during this financial year an order for the construction of a Diesel-electric locomotive of a new type, the negotiations of the Commissariat with the Trusts having been fruitless, as the latter would not agree to undertake the construction before next year, 1927-28. The type which the Commissariat is anxious to have built is a new form of the GE 16 on the Hakkel system. The Glavmetall finds that the Kolomenski works cannot take the order as they have chosen another type of locomotive for construction; the Charkov locomotive works have not included the building of Diesel locomotives in their programme, while the Putilovski works say that, owing to their being overwhelmed with other orders, they cannot accept one for a new type of locomotive. The Glavmetall has accordingly asked the Leningrad Engineering Trust (Leningradmashtrest) to consider if it is possible to start work on the new locomotive in the course of the present business year.—*Reuter's Trade Service* (Moscow).

Selenium Cells.—At a recent meeting of the Physical Society of London, Prof. Thirring demonstrated selenium cells. The lecturer, who is Professor of Theoretical Physics at the Vienna University, explained that the sensitivity of such a cell depends a great deal upon the thinness of the selenium coating, since only the surface layer is influenced by light. Experience has shown that with condenser-type cells the thickness of the selenium coating can be reduced to any desired value by the capillary action of suitably chosen electrodes; the condenser type is convenient also for making selenium cells of very small light-sensitive area, without unduly increasing the resistance. The following table indicates the approximate resistances of examples of the standard types of cells shown, which have been made according to the author's patents by Messrs. J. Malovich & Co., in Vienna:—

Light-Sensitive Area.	Microamperes at 12 volts. Dark.	Illuminated 100 metre candles.
Circular, 1 mm. diam.	0.2	2.5
Rectangular, 0.14 by 10 mm. ...	0.1	3.8
Rectangular, 1 by 10 mm.	0.1	6.0
Circular, 5 mm. diam.	3.0	24.0
Rectangular, 7 by 35 mm.	72.0	432.0

The advantage of a small light-sensitive surface lies in the fact that a focusing lens which concentrates the light on the cells can be used. Since the ratio between dark resistance and light resistance depends on the intensity of illumination (energy per unit area), a small cell can be used more efficiently than a large one with equal electrical properties. It does not seem to be possible to remove all the deficiencies which are naturally inherent in selenium cells, among which the following may be mentioned:—(*a*) The resistance is not a linear function of the intensity of illumination; (*b*) it has a temperature coefficient; and (*c*) the reaction to light is not instantaneous. Selenium cells should, therefore, be used in an arrangement which compensates so far as is possible these deficiencies for the given purpose. A very efficient device is the use of the cells with an intermittent illumination of acoustical frequency, the cell being coupled with an amplifier. It is important in this case that there should be no spontaneous rapid fluctuations of the resistance, for these give rise to grating noises. In this respect also the cells shown are superior to those of the grid type, because of the better electrical contact at the electrode. One of the experiments illustrated an arrangement of this kind. The filament of a small 6-volt lamp was focused upon a selenium cell with a sensitive area of 1 mm.², by means of two lenses 4 cm. in diameter, over the length of the lecture table. The light was interrupted by means of a phonic wheel rotating close to the lamp. The fluctuating current in the selenium cell was amplified and made audible throughout the theatre by means of a loud-speaker. Another experiment illustrated the advantages of balancing two selenium cells in a Wheatstone bridge arrangement; by exposing the cells alternatively to illumination the balance was upset in opposite directions.

A Composite Hydro-electric Installation. — A hydro-electric power station utilising the water power of the River Agar, near Lenzing, Lower Austria, has recently been completed for the supply of power to the works of the Lenzing Paper Manufacturing Co. The plant, which comprises two Francis-type vertical-spindle turbines each developing 610 h.p. at a speed of 62½ r.p.m., is interesting from the somewhat novel driving system that has been adopted. Instead of being coupled direct to the generators, the upper ends of the turbine spindles terminate in bevel crown wheels, which mesh with bevel pinions mounted on a long countershaft. The latter runs at a speed of 250 r.p.m., the gear ratio being thus 4 to 1. The extended portions of the turbine spindles run in two bearings, thrust bearings being also provided to take the thrust of the bevel gearing. At one end of the countershaft is mounted the electric generator, while the other extends into a wood-grinding department and is provided with belt pulleys. The bevel crown wheels are mounted on the turbine spindles in such a way that when only one turbine is required, the crown wheel of the other can be lowered out of engagement with its corresponding bevel pinion. The horizontal countershaft is also provided with friction couplings so that one turbine can be used for driving the generator and one for driving wood-grinding machinery, while as occasion demands, both turbines can be coupled up to one side or the other.

Electricity in Brickyards.—In the production of bricks, amounting to something like 600,000,000 per year, by the London Brick Company & Forders, Ltd., electric power assumes importance. The operations carried out at this company's many large yards involve the transportation of clay for considerable distances from the pits to the works, and again in the conveyance of the bricks from the presses to the kilns. These operations are carried out largely by electric locomotives hauling trucks, supplied with power from overhead cables. In addition, many miles of cables of all sizes and capacities are used for the distribution of power for driving motors, lighting, and other purposes. Overhead lines conduct three-phase current at 6,600 and 440 volts. The lines consisted of six No. 6 S.W.G. solid bare copper conductors erected on single-member wood poles.

Tidal Power from the River Exe.—A project for the development of cheap electrical power from the tides in the estuary of the River Exe was discussed by the Exmouth Rotary Club recently. Mr. E. L. Fleming, its leading advocate, stated that since public attention was first drawn to the matter about a month ago, the formation of a company had been suggested. He had communicated with the Port of Exeter Authority, and had received a reply that the request for the City Council's permission for the placing of turbines in the River Exe would be placed before the next meeting of the Navigation Committee. The Board of Trade, in reply to a request for consent to the mooring of a vessel in the River Exe for the purpose of generating electric current, asked for further information. A letter had been written to the Electricity Commissioners in the following terms:—"At Exmouth we have a channel 400 yards wide through which the tide passes in the estuary of the Exe, covering an area of 600 acres, 4 ft. deep, or 30 million tons of water flowing in and out every six hours, causing a current of from three to six knots. . . . Has this power been used in any other place in the world similarly situated to Exmouth, and with what results?" A reply had been received from the Electricity Commissioners to the effect that the Water-power Resources Committee in its report published in 1920, pointed out the difficulties which had to be overcome in harnessing the tides. The Committee recommended that a Technical Commission be set up to investigate the possibility of utilising the tides for power purposes, with special reference to the Severn estuary. This matter had formed the subject of subsequent investigations on behalf of the Government, and the Commissioners understood that a marine survey of the country was now being carried out. Although experimental efforts in respect of this problem had been made in other countries, the Commissioners were not aware of any installation at which it had been demonstrated beyond question that the harnessing of the tides for the production of electricity on a large scale was an economic commercial project.

Since the receipt of this letter from the Electricity Commissioners, a local Technical Committee had been appointed, which had decided to take the advice of a civil engineer who knew the mouth of the Exe, and he was now considering the matter. Mr. Fleming, commenting upon suggestions that the cost might work out at a penny a unit, said he would not commit himself to any statement that the cost would be so low as that.

In proposing a vote of thanks to Mr. Fleming, Mr. Mann, local manager of the Electric Supply Corporation, remarked that it would be far from the ideas of the Electric Supply Corporation to oppose such a scheme; if it could get

a bulk supply cheaper than it could generate, there would be no point in generating on present lines. Doubtless there was a tremendous power in the tides, but it was doubtful whether it was a commercial proposition to reclaim that power, and that was a matter for experts to decide. Distribution charges would account for a greater sum than a penny per unit, and there was a possibility that the capital necessary for such a project would be out of all proportion to the possible revenue. An expensive feature of the scheme would be the batteries to store the energy generated until it was required.

The Meter Engineers' Technical Association.—At a meeting of the Association on November 18th, Mr. E. W. Hill, A.M.I.E.E., delivered a lecture on "Points of View in Metering Theory." After briefly alluding to certain errors frequently perpetrated in test calculations, he proceeded, with the aid of graphic illustrations, to propound his views upon sundry fundamental principles which govern meter practice, particularly with regard to induction meters; the much-discussed question of power factor; quadrature compensation; and the setting-out of polyphase vector diagrams. Mr. W. Holmes, in opening the discussion, offered very convincing reasons for the inclusion of quadrature compensation in the series circuit of certain meters. The discussion was well maintained.

An Electric Lamp Curio.—Another instance of the survival after rough usage of an electric lamp is depicted in the accompanying illustration. It was discovered in the hollow keel of H.M. submarine L9 after her refloating at Hong Kong. It will be recalled that the vessel was caught in a typhoon, and after colliding twice with the dockyard jetty was so severely holed that she sank. The lamp, which must have been placed

An Encrusted Electric Lamp.

in the keel at some time prior to the accident, bears the signs of long immersion, for it was discovered encrusted with coral-like growths, but the filament was found to be unbroken. The finder said: "I plugged it into a holder when, to my surprise, it lit and burned steadily." The lamp was of Ediswan manufacture.

The Quality of Electrical Appliances.—In an editorial entitled "Why Not an Electrical Appliance Laboratory?" the *Electrical World* writes as follows concerning the need for encouraging the use of better-quality electrical appliances. The comments, of course, relate to conditions in the United States:—"Several of the larger manufacturers of electrical appliances have exerted powerful influence to the end that the quality of their products shall be maintained at a high level; many of the smaller manufacturers have striven toward the same object, and in general this has been accomplished. Recently, however, less scrupulous manufacturers have entered the field with cheap and poorly-constructed appliances. These lead to numerous service calls and frequently are the cause of great dissatisfaction on the part of the user. It should be the aim of the light and power company to encourage the better grade of appliances as against those which are poorly constructed and are offered in competition at low prices. In this connection many central-station companies have adopted the practice of testing out appliances and approving them before they are placed in the display rooms and offered to the public. *Good Housekeeping* has established such a service for the benefit of its readers, and the label of that periodical has become familiar. Why should not electrical inspection and approval be made by a national laboratory supported by and carrying the name of the National Electric Light Association? Such a laboratory should be productive of great economies in carrying out inspection and approval, and would do a great deal to encourage the better construction of appliances, because the weight of central-station prestige back of the approvals of this laboratory would be a forceful incentive to manufacturers to improve quality in cases where incentive is necessary."

Railway Accident Prevention.—The German railway authorities have successfully tested on a Berlin suburban railway a new device for preventing mishaps to trains, especially in foggy weather. Transmitted from the block signal, an elecric current acts upon the brakes of the engine, which are thereby automatically applied. Tests are now to be made on the Hamm-Oberhausen line, where fog is especially prevalent, and if successful it is expected that all German railways will be equipped with the new device by the end of next year.—*Reuter* (Berlin).

Radio-Telephony in Army Manœuvres.—During recent manœuvres with the Regular Army, the 23rd (London) Armoured Car Company, a Territorial unit of the Royal Tank Corps, carried out extensive and highly successful tests in radio-telephonic transmission between moving armoured cars. Storage batteries, supplied by Messrs. Peto & Radford, were used for running the 1,000-volt generator and for lighting the filaments of the valves in the transmitting and receiving sets, and though treated with little respect and continually subjected to the jolting motion of the cars, played their part throughout without a fault.

B.E.S.A. Publication.—The British Engineering Standards Association has recently issued a specification which deals with British standard switchgear equipments for d.c. circuits on pressures not exceeding 660 V. It is divided into the following sections:—D.c. feeder equipments for single-, two-, and three-wire service, employing circuit breakers for overload protection; d.c. feeder equipments for single-, two-, and three-wire service, employing fuses for overload protection; d.c. generator equipments for two- and three-wire service; d.c. rotary-converter equipments for two- and three-wire service; paralleling voltmeter equipments. The publication gives in tabular form full details of the standard equipment, together with the optional equipment which may be used in certain cases. In addition, a diagram is given for every type of circuit covered, showing in symbolic form the lay-out of the equipment. There are 40 such diagrams, which illustrate very strikingly how it is possible to combine the British Standard symbols (as given in B.E.S.A. Publication No. 108 and as shown in the latest decisions of the International Electrotechnical Commission) into a comprehensive diagram. Copies of this new publication (No. 194-1926) may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, S.W.1.; price 1s. 2d. post free.

A New Plug to B.C. Adaptor. — With reference to the description of the new adaptor of Messrs. A. P. Lundberg and Sons, published in our last issue under the above heading, we are asked to state that the name of the insulating material employed should read "Cocusite" and not "Cosnite."

Local Societies.—Mr. A. C. Baker, chief engineer of the Birmingham Corporation Tramway Department, speaking on November 12th at a meeting of the Birmingham Electric Club on the subject of electric tramways, said that those who cried, "Scrap the Trams" gave little thought to the financial aspect of the question. A tramcar seating from 60 to 80 passengers cost less to the city than a motor-omnibus seating only 50 people, in spite of the fact that the Tramway Department had to maintain the whole of the paving of the tramway area. On the lines in Birmingham the Department paid £78,000 in rates per annum, so that if motor-omnibuses were substituted for trams the city would lose that amount and also have to maintain the 80 miles of roads. The biggest factor of all would be the repayment of the outstanding capital of approximately £2,000,000. Even if motor-omnibuses were cheaper and much more speedy and comfortable than tramcars, the substitution could only take place by a slow process of evolution. The latest type of tramcar brought into service in the city during the past few weeks, he added, was quite equal to the modern omnibus both for speed and comfort. They were equipped with 60-h.p. motors, and travelled at 30 miles an hour when fully laden, and they were also fitted with air as well as hand and magnetic brakes.

Static Currents.—According to the *Daily Express*:—"The municipal authorities of Vienna are contemplating turning the streets of the city into a gigantic foot-warmer for the winter by fixing electric currents under the pavements and roads."

Better Mill Lighting.—Mr. R. C. Hawkins, of the Manchester Electric Lighting Service Bureau, addressed the Blackburn Managers' Mutual Association on November 18th on scientific mill lighting. He urged that inefficient lighting was expensive and wasteful, and in the mill there were many places where improved systems could increase production. On the loom spoiled work meant loss of money, loss of time, and loss of material, not merely on the loom itself, but in all other departments, and manufacturers might profitably introduce new methods in the interests of themselves and their workpeople. He did not recommend the indiscriminate employment of gasfilled lamps, but their judicious use in a scientific scheme of mill lighting.

Electric Vehicles in Germany.—The Berlin Motor Cab Co. has recently ordered 500 electric taxi-cabs, of which some are already on the streets. Each vehicle weighs only one ton, complete with the battery, and is capable of travelling 75 miles on one charge. The accumulators are contained in a bonnet at the front and are lifted out when necessary by means of a crane. A single motor is employed, this being situated under the driver's footboard; it drives through a spur reduction gear to a propeller shaft with flexible disk joints, leading to an axle of the ordinary motor-vehicle type.

The Electrical Engineers' Ball.—This very popular annual event is to take place at the Hotel Cecil on Friday, February 11th.

Midland Electrical Engineers' Ball.—The first of the three electrical engineers' dances which now appear to have become quite definite yearly fixtures, was held in Birmingham at the Grand Hotel on Friday, November 19th, the attendance (which was a record for the Midland function) totalling 450. The president, Mr. R. A. Chattock, was well supported by his brethren of the electricity supply industry and most, if not all, of the larger electrical engineering concerns were well represented by the most handsome and agile of their Charleston exponents. We do not know whether there is something in the Birmingham air which has such a cheery effect on all those attending the Midland dance, but it is certain that it would not be easy to find another large function at which everyone appears to be so thoroughly at home. Almost everything, of course, depends on the extraordinarily good staff work which enables so large a gathering to be handled without a hitch, and in this connection we again congratulate most heartily the self-effacing but entirely indispensable. Mr. W. Y. Anderson and his executive colleagues. Their only reward lies in the satisfaction which arises from having done a good thing well, and we hope that they feel with us that everybody had a thoroughly good time.

The Industrial Welfare Society.—The Industrial Welfare Society has issued its eighth annual report covering the year ended June 30th last, together with a balance sheet for the period. This is a record of an enormous amount of work which has no doubt accomplished much for the health and general well-being of a large number of workers in all kinds of industries. It is disappointing to learn that in spite of rigid economies the Society incurred a deficit of £1,627 during the year. The late hon. treasurer says that further economies seem impossible if the work is to be continued, and further funds are appealed for.

Accident.—A workman named Duncan Gordon, of Roseburn Drive, Edinburgh, sustained a severe electric shock last week while working in the Monktonhall transformer station of the Lothian Electric Power Co., Ltd., near Musselburgh, and was removed to Edinburgh Royal Infirmary.

Lantern Lecture.—At a meeting of the Bradford Engineering Society, last week, a kinematograph film, lent by Messrs. C. A. Parsons & Co., Ltd., Newcastle-on-Tyne, was exhibited, showing the erection at their works of the 50,000-kW steam turbo-alternator exported to America in 1924 for the new power station of the Commonwealth Edison Company of Chicago. Professor G. F. Charnock, lately retired head of the Engineering Dept. at the Bradford Technical College, gave a description, aided by lantern pictures, of the chief features of the machine, which was put into commission at Chicago in May, 1925, and has been the biggest turbo set in the world until the coming installation at Hell Gate Station of the United Electric Light & Power Co., of New York, ordered in July last and to have a continuous rating of 160,000 kW. By permission of Mr. Thos. Roles, the Bradford City electrical engineer, a second film was shown illustrating the construction and erection of the new 20,000-kW steam turbine turbo-alternator at Bradford.

An E.T.B.I. Ball.—The eighth annual ball of the Electrical Trades Benevolent Institution (North East Coast) will be held at the Old Assembly Rooms, Newcastle-on-Tyne, on Friday, December 10th. Guests will be received by Mr. H. A. Couves and Mrs. Frank Bottomley.

E.A.W. Visit.—The first visit of the Manchester District branch of the Electrical Association for Women took place on November 13th to the Salford Corporation power station at Agecroft. The members were welcomed by Alderman Billington, chairman of the Electricity Committee, and Mr. S. J. Watson, the city electrical engineer. The success of the visit was evident by the enthusiasm shown by the members. Mrs. H. C. Lamb, on behalf of the Association, thanked the authorities for their courtesy in arranging the visit and providing tea.

A large number of members visited the Coliseum, London, on November 17th, and inspected the stage lighting arrangements. The party was especially interested in the natural daylight effects which were obtained. At the end of a very fascinating hour the audience was asked to guess the cost of the electricity used, which was less than 35s. per week. Miss M. Partridge gave an interesting talk on the same afternoon at the London Lighting Service Bureau on "Tariffs," when Mrs. Llewelyn Atkinson took the chair. In order to describe to her audience various costs which went to make up the price of a unit of electricity, she likened the power station to a dressmaking business.

A very interesting discussion followed, and some meters and parts which had been sent by Dr. Ferranti were explained to the members, as also was the reading of a meter. At the conclusion of this meeting a party of the members went on to see the stage lighting showroom of the General Electric Co., Ltd. On November 18th, at the invitation of Mr. J. S. Bush, of the Delco Light Co., a party of members visited the Cookery and Food Exhibition, Olympia.

It is proposed to form a Cheltenham branch of the E.A.W., and a meeting was to be held on November 25th at the Town Hall, Cheltenham, for this purpose. The Mayoress of Cheltenham was to have presided, with Miss C. Haslett, director of the Association, as the principal speaker.

Meeting Postponed.—THE ELECTRICAL SOCIETY OF GLASGOW.—The date of the next meeting has been altered from December 6th to 17th, when Mr. G. H. Rowbottom will deliver his paper on "Notes from the Diary of an Electricity Salesman."

Association of Mining Electrical Engineers.—The Association is circularising its members with a view to the inauguration of evening classes in electricity in mines at its various centres.

Institution Note.

Institution of Electrical Engineers.—ORDINARY MEETING.—At the ordinary meeting, to be held on December 2nd, a portrait of Michael Faraday, by Mr. George Harcourt, R.A., and a reproduction of the portrait of Lord Kelvin, by the same artist, painted by Herkomer for the Institution of Civil Engineers, will be shown in the lecture theatre of the Institution in the positions allotted to them. After some introductory remarks by the President, the portrait of Faraday will be presented to the Institution by Mr. Sydney Evershed.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. WALTER E. FRENCH, whose portrait accompanies this note, is the present chairman of the North Midland Centre of the Institution of Electrical Engineers. Practically the whole of Mr. French's engineering training was received in Germany; he studied electrotechnics at the Technische Hochschule Berlin-Charlottenburg. He was then engaged successively upon the engineering staffs of the Electrical Company, London, the British Thomson-Houston Co., Ltd., Rugby, Messrs. Bruce Peebles & Co., Ltd., Edinburgh, and Siemens Bros. Dynamo Works, Stafford. Finally, he was appointed lecturer in electrical engineering at the Leeds University, a position which he still holds. During his career Mr. French has been engaged upon central station lay-out, and the design and construction of electrical machinery of all kinds. He undertook research work and comprehensive tests in connection with the Central London Railway. He has also done a considerable amount of experimental and research work on flameproof machinery for coal mines; he read a paper on this subject before the Institution of Mining Engineers in London. This work was interrupted by the war. He then received a commission in the West Yorks. Regiment, but was subsequently transferred to the Royal Engineers, being first with the 233rd Field Company and later with the 351st E. & M. Company in France from 1916 to the end of the war. He obtained the rank of captain. At the present time Mr. French is interested in d.c. high-pressure transmission, asynchronous generators, and the radiant efficiency of electric fires.

Elliott & Fry [*London*

Mr. W. E. French,
Chairman of the North Midland Centre, I.E.E.

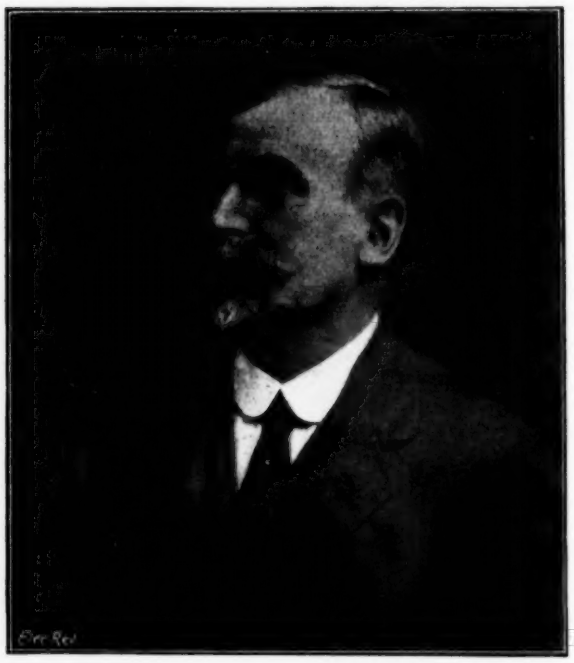
Mr. A. WILLEY, who is leaving the staff of the Marconi Co., of Chelmsford, after 15 years' service, has been presented with a gold watch, a silver salver, and a silver cigarette-box.

The gifts were handed to Mr. Willey on behalf of colleagues at Chelmsford and London by Mr. H. M. Dowsett, chief of the testing department, on November 13th.

To celebrate the 25th anniversary of the Tynemouth Corporation Electricity Works, the staff and members of the Department were entertained at a dinner given by Mr. and Mrs. C. Turnbull. The Mayor, Councillor R. Irvin, who was in the chair, is also chairman of the Electricity Committee. He paid a tribute to the work of Mr. Turnbull, who has held his position from the beginning of the station. The vice-chairman, Councillor Armstrong, referred to the gratifying progress of the undertaking. Mr. J. Waller, the oldest member of the staff, then asked Mr. and Mrs. Turnbull to accept a memento of the occasion in the shape of a cut glass electric table standard; this was presented by Mr. Murray, the oldest workman.

Mr. G. W. Moore, manager of the Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool, and director of the International Automatic Telephone Co., Ltd., London, recently returned from a business tour of the United States lasting several weeks, during which he visited leading industrial establishments.

Last week, Mr. James Dalrymple, who has been tramway manager to the Glasgow Corporation for the past 22 years, and has been 46 years in the Corporation service, intimated his willingness to resign his position. He had firmly refused to reinstate 316 tramwaymen who were dismissed from the service after the General Strike. A recommendation was passed by the Tramway Committee by a majority of five votes to reinstate the men and it was after this that Mr. Dalrymple's decision was announced. It is stated that a sub-committee



Lafayette] *[Glasgow.*

Mr. James Dalrymple.

was appointed to arrange terms on which the resignation would be accepted. There is understood to be a majority of five on the Tramways Committee, but the matter mentioned has to come before the next meeting of the Corporation.

On November 17th, the Chancellor of the University of Manchester conferred the honorary degree of Doctor of Science upon a number of well known men, including Mr. S. L. Pearce, late Electricity Commissioner, formerly city electrical engineer of Manchester, and "A Master of Electricity." The ceremony was to have taken place last May but had to be postponed owing to the General Strike.

Mr. Henri Speciael, of Brussels, has been elected a director of the Anglo-Argentine Tramways Co., to fill the vacancy caused by the retirement of Mr. H. F. Gunning.

Obituary.—Mr. W. M. Nelson.—Mr. W. M. Nelson, chief engineer of the Brisbane tramways, died suddenly on October 5th, aged 55 years. He was a son of Sir Hugh Muir Nelson, who was Premier of Queensland for many years. In 1900 Mr. Nelson was appointed chief engineer and manager of the Greenock Corporation electricity supply undertaking. From 1908 to 1910 he was employed by the Launceston Municipal Council in the preparation of drawings and specifications for the inauguration of its electric tramway system, after which he supervised the construction. Later he was for three years chief engineer to the Christchurch Tramways Board, and in 1921 he was appointed chief engineer to the Brisbane Tramways Co.

Mr. A. Higgs.—We regret to learn of the death, which occurred on November 16th, of Mr. Arthur Higgs, who had for over 20 years been manager of the instrument department at the works of Messrs. Ferranti.

New Companies Registered.

Selectors, Ltd. (217,633).—Private company. Registered November 13th. Capital, £1,000 in £1 shares. Objects: To carry on the business of makers of and dealers in wireless sets, apparatus and component parts, &c. The subscribers (each with one share) are:—W. M. Rolph, Calder House, 1, Dover Street, W., engineer; F. Hay, 9, Lincoln's Inn Fields, W.C.2, solicitor. W. M. Rolph shall be permanent governing director at a salary of £200 per annum. Secretary: L. G. Thompson. Solicitors: Robins, Hay, Waters and Hay, 9, Lincoln's Inn Fields, W.C.

W. D. Meagher, Ltd. (217,551).—Private company. Registered November 16th. Capital, £100 in £1 shares. Objects: To acquire the business of a manufacturer and repairer of, agent and concessionaire for, and dealer in goods, parts and accessories appertaining to and used in connection with motor vehicles of all kinds and internal combustion engines, magnetos, dynamos and starter motors for lighting, power, and all other purposes carried on by W. D. Meagher at 232, Deansgate, Manchester, at 85, Terminus Chambers, 6, Holborn Viaduct, E.C.1, and at 122, Bothwell Street, Glasgow. The permanent directors are:—Mrs. M. Meagher, 4, Blair Road, Alexandra Park, Manchester; W. D. Meagher, 4, Blair Road, Alexandra Park, Manchester (managing director). Solicitor: H. E. Kay, 40, King Street, Manchester. Registered office: 232, Deansgate, Manchester.

Radioptics, Ltd. (217,494).—Private company. Registered November 13th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with A. Salomon, and to carry on the business of manufacturers and importers of and agents for the sale of dynamos, magnetos, accumulators and batteries; manufacturers, importers and distributors of and dealers in all kinds of wireless instruments, sets and parts, gramophones, electrical fittings and apparatus, kinematograph fittings and accessories and pocket kinemas, opticians, manufacturers of and dealers in lenses, spectacle and eyeglass frames, photographic and astronomical instruments, dealers in toys of all kinds, manufacturers of and dealers in appliances for jewellers, watch and clock makers and repairers, &c. The subscribers (each with one share) are:—A. Salomon, Drinkwater Arcade, Coventry, optician and wireless factor; Mrs. R. Salomon, 22, St. Patrick's Road, Coventry; H. Parnell, Holly Croft, Fife Road, Coventry, optician. A. Salomon is permanent governing director with £100 per annum as remuneration. Solicitors: Browetts, 23, Bayley Lane, Coventry. Registered office: Spon End Works, back of No. 53, Spon End, Coventry.

Lunar Electrical Co., Ltd. (217,561).—Private company. Registered November 17th. Capital, £100 in £1 shares. To adopt an agreement with W. R. Preston and A. M. Scales, carrying on business as "The Lunar Electrical Company," at 3-7, New Street Square, E.C., and to carry on the business of electrical machine and accessory merchants as formerly carried on by the said company, and that of electricians, mechanical engineers, manufacturers and workers of, and dealers in electricity, motive power and light, manufacturers of telephones, telegraphs (wireless or otherwise), &c. The permanent directors are:—W. R. Preston, "Midlands," 2, Claremont Gardens, Surbiton (director of A. P. Maylen Ltd); A. M. Scales, 203, Barcombe Avenue, S.W.2, electrical merchant. Qualification, 10 shares. Remuneration as fixed by the company. Solicitor: J. H. John, 40, Russell Square, W.C.1. Registered office: 3-7, New Street Square, E.C.4.

Electrodes, Ltd. (217,593).—Private company. Registered November 18th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and repairers of electrodes or any part thereof for electric are welding, electrical, wireless, and general engineers, &c. The subscribers (each with one share) are:—J. L. Graham, "The Stud," Carlton-on-Trent, Notts., engineer; N. Phillips, 29k, Station Road, Sutton-on-Trent, Notts., clerk. J. L. Graham is permanent governing director. Qualification of governing director, £25. Solicitors: Rothera and Sons, 46, Bridlesmith Gate, Nottingham.

C. A. Sothers, Ltd. (217,590).—Private company. Registered November 18th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrical engineer carried on by C. A. Sothers at 156, Hockley Hill, Birmingham, and to carry on the same and the business of wireless, mechanical, and general engineers, manufacturers of, and dealers in electric, magnetic, telephonic, telegraphic, wireless, and other appliances, electrical and wireless plant, &c. The directors are:—C. A. Sothers, 11, Broadfields Road, Erdington, Birmingham, electrical engineer (managing director); C. H. Hoskins, "The Homestead," Harman Road, Erdington, Birmingham, cheese merchant (both permanent). Qualification, 1 share. Secretary: Elizabeth R. Priest, 125, Ellen Street, Brookfields, Birmingham.

Woodscott Electrical Co., Ltd. (217,552).—Private company. Registered November 16th. Capital, £200 in £1 shares. Objects:—To carry on the business of electrical and mechanical engineers, fitters, millwrights, founders, tube makers, galvanisers, japanners, annealers, enamellers, welders, &c. The first directors are:—J. F. L. Scott, 51, Chapel Street, Chorley; T. E. Woodhead, 26, Charles Street, Blackpool. Qualification, 1 share. Remuneration, £5 each per annum. Secretary: J. F. L. Scott. Registered office: Manor Chambers, 26, Central Drive, Blackpool.

Official Returns of Electrical Companies.

British Battery Co., Ltd. (137,905).—Capital, £1,000 in 800 preference and 200 ordinary shares of £1 each. Return dated June 20th, 1925 (filed September 11th, 1926). 800 preference and 199 ordinary shares taken up. £999 paid. Mortgages and charges, nil.

Macintosh Cable Co., Ltd. (72,097).—Capital, £100,000 in 75,000 ordinary and 25,000 preference shares of £1 each. Return dated August 26th, 1926. 51,008 ordinary and 23,997 preference shares taken up. £13,004 paid. £62,001 considered as paid. Mortgages and charges, £6,500.

Electrical Power Fitting Co., Ltd. (186,732).—Capital, £500 in £1 shares. Return dated September 10th, 1926. 305 shares taken up. £218 3s. 10d. paid, leaving £86 16s. 2d. in arrears. Mortgages and charges, nil.

Pritchett & Gold and E.P.S. Co., Ltd.—Charge on factory premises and land abutting on Chequers Lane, Dagenham, dated September 29th, 1926, to secure £18,000. Holders: Samuel Williams & Sons, Ltd., 8, Lloyd's Avenue, E.C.

Eunice Wireless Cabinet Works, Ltd.—Particulars filed of £400 debentures authorised November 2nd, 1926, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £300.

British Di-Electric Co., Ltd.—Particulars filed of £1,000 debentures authorised October 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £150.

General Electric Co., Ltd.—Satisfaction to the extent of £45,900 on November 6th, 1926, of debenture stock dated July 22nd, 1927, securing £3,500,000.

J. H. Runbaken, Ltd.—Particulars filed of £1,500 debentures authorised October 22nd, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

South American Light and Power Co., Ltd. (74,446).—Capital, £200,000 in £1 shares. Return dated November 4th, 1926. 180,000 shares taken up. £130,007 paid. £49,993 considered as paid. Mortgages and charges, £119,800.

Frederick Braby & Co., Ltd. (2,537c).—Capital, £60,000 in 42,500 ordinary, 17,500 preference, and 6,000 employés' shares of £10 each. Return dated August 31st, 1926. 37,500 ordinary, 14,500 preference, and 4,500 employés' shares taken up. £585,000 paid. Mortgages and charges, £30,925.

C. F. Casella & Co., Ltd. (106,869).—Capital, £17,000 in 15,000 ordinary and 2,000 preference shares of £1 each. Return dated October 27th, 1926. 12,204 ordinary and 2,000 preference shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges, £1,500.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Chelsea Electricity Supply Co., Ltd.

An extraordinary general meeting was held on November 18th to consider resolutions providing (*a*) for the increasing of the capital to £450,000 by the creation of 50,000 ordinary shares of £1 each, ranking *pari passu* with the existing ordinary shares; and (*b*) for the capitalisation of £148,308 of the reserves for distribution in the form of ordinary shares to existing ordinary shareholders in the proportion of three new shares to each five held. In moving the resolutions, the chairman (Mr. W. R. Davies) reviewed the agreement between the company and the London County Council which, he said, provided that the company's dividend on the existing capital should be limited to 10 per cent. up to December 31st, 1931, and that on the new capital to 7 per cent. He pointed out that the distribution of bonus shares was smaller than that made by some other companies on account of the larger proportion of ordinary capital employed by the company. The position of the ordinary shareholder was that he would obtain 14.4 per cent. upon his holding until December 31st, 1931, and 11.4 per cent. thereafter. In conclusion, the chairman said that after the final settlement with the L.C.C. there would be a surplus which they proposed to devote to the institution of a superannuation fund. The resolutions were carried unanimously.

Submarine Cables Trust.

A meeting of the certificate holders was held on November 17th, when Sir John Denison-Pender, G.B.E., who presided, said that the trustees had decided to redeem the remainder of the certificates (333) outstanding. They had brought forward the date for the division of the net proceeds among the holders of the coupons of reversion. Since the date of the report they had realised their holding in the American Telegraph and Cable Co., and the profit derived from the sale of the whole of their securities would be approximately £279,500. The deed provided that the maximum total expenses in any year should not exceed £2,000. During the 55 years the trust had been so successfully administered that the saving had been £32,000. The report and accounts were adopted, and a resolution was passed for the remuneration of the trustees during the winding up.

It is stated that the distribution which is to be made early in December to holders of reversion coupons will amount to at least £151 per coupon.

County of London Electric Supply Co., Ltd.

Meetings of shareholders were held on Tuesday last for the purpose of considering alterations in the company's articles of association. The first was a general meeting at which the cumulative nature of the preference dividend was made clear by a minor amendment. Another resolution provided that the preference shares should rank in priority to the ordinary shares for the return of the capital paid in the event of a winding up. The ordinary shareholders would then receive back their investment and any surplus would be divided *pro rata* between the two classes. The board was also given power to capitalise by resolution any part or the whole of the undivided profits and reserves for issue to the ordinary shareholders. After the general meeting separate meetings of the two classes of shareholders were held for the purpose of confirming the resolutions.

Southern Brazil Electric Co., Ltd.

The annual meeting of this company was held last week, Mr. E. H Tootal (chairman) presiding. In presenting the report, which was reviewed in our last issue, the chairman said that a satisfactory feature was the liquidation of the income-tax debt. The installations of the company and its subsidiaries had been kept in good order and the earnings showed a steady increase. They were obliged to restrict capital outlay to a minimum. Brazil had gone through a severe financial crisis, but an improvement had set in and the company's revenues were not affected. After rising for some time the exchange had suddenly fallen this year, but they were hopeful that the erroneous impressions which caused the fall would soon be removed. The report and accounts were adopted.

Western Telegraph Co., Ltd.

The report for the year ended June 30th last records a revenue of £1,541,100 and working expenses amounting to £839,881. The balance, after providing for debenture interest and income tax, is £590,626, and to this is added £300,440 brought forward, making £891,066. Of this, £250,000 has been transferred to general reserve, four dividends of 2½ per cent. each, free of tax, have been paid, and a balance of £329,171 is carried forward. The directors have appointed Vice-Admiral H. W. Grant, C.B. (joint managing director of the Eastern Telegraph Co., Ltd., and a director of the Eastern Extension, Australasia and China Telegraph Co., Ltd.) to a seat on the board, and this appointment was to be submitted at the annual meeting yesterday (Thursday) for confirmation.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Kensington and Knightsbridge Electric Lighting.—294,000 ordinary shares of £1 each, fully paid, Nos. 1 to 294,000.

American Telephone and Telegraph.—$1,288,200 capital stock.

The undermentioned have been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$1,288,200 capital stock.

Argentine Light and Power Co., Ltd.—134,189 7 per cent. preference (cumulative) shares of £1 each fully paid, Nos. 865,812 to 1,000,000.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—294,000 ordinary shares of £1 each fully paid, Nos. 1 to 294,000.

Lancashire United Transport and Power Co., Ltd.—£250,000 6 per cent. first mortgage debenture stock.

Underground Electric Railways Co. of London, Ltd.—4,868,878 ordinary shares of £1 each fully paid, Nos. 1 to 4,868,878.

Brazilian Traction, Light and Power Co., Ltd.—Earlier in the week the directors issued a public notice stating that their attention had been drawn to a proposal made to the holders of the company's ordinary shares by Mr. Alfred Lowenstein, on behalf of a new Canadian company, offering shares in this new company in exchange for the Brazilian Traction shares. This, it was stated, would apparently result in a fusion or alliance with other companies not connected with Brazil, which would not be in the company's interests. The board accordingly advises shareholders not to exchange their shares.

Quebec Power Co.—At a meeting held last week in Montreal a bye-law was confirmed providing for the redemption of the issued preferred stock and the conversion of the unissued preferred stock into common stock. Holders of the stock are given the option of converting their holdings. Another bye-law was approved increasing the capital stock of the company from $10,000,000 to $15,000,000.

A dividend of $1¾ has been declared upon the preference shares for the quarter ending December 31st.

New Issues.—*Perak River Hydro-Electric Power Co., Ltd.*—The issue of £1,250,000 of 5 per cent. debenture stock met with so many applications that the list was closed in the afternoon of the day of issue.

Ever-Ready Co. (Great Britain), Ltd.—The directors are making an issue of 71,200 ordinary shares to existing preference and ordinary shareholders in the proportion of one new share to each seven held, fractions being ignored. The price of issue is 50s. per share.

Charing Cross Electricity Supply Co., Ltd.—The directors recommend that £160,800 of the reserves of the General Undertaking be capitalised and distributed as fully-paid shares to the holders on December 6th, 1926, of the existing ordinary shares in the proportion of four new shares for every five shares then held. The resolutions necessary to give effect to this recommendation will be submitted at an extraordinary general meeting on Monday, December 6th.

London Electric Supply Corporation, Ltd.—Extraordinary meetings of shareholders were to be held on Wednesday last to consider resolutions providing for the capitalisation of part of the undivided profits and reserves, and for the subdivision of each of the unissued £5 shares into five shares of £1 each.

Shawinigan Water and Power Co.—The board has passed a bye-law converting each $100 share into four new shares of no par value. Upon confirmation this will extend to both issued and unissued shares.

Stanton Ironworks Co., Ltd.—An interim dividend of 4 per cent. actual, free of tax, has been declared on the ordinary shares, as in 1925.

Chloride Electrical Storage Co., Ltd.—An interim dividend of 5 per cent., free of tax, has been declared on the ordinary shares, as in 1925.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have been a good deal disturbed by the extraordinary recovery which has occurred in the value of the franc. French people have been doing their best to sell stocks and shares, in order to buy French currency, on the assumption that, if the franc is going to 100, as prophecy gaily maintains, it will be better to hold credits than securities. The sequel is seen in severe falls amongst stocks and shares which enjoy an inter-bourse market, and the effect is spread much more widely than might be supposed.

Generally speaking, the influence of the franc fluctuation has been to depress values, although at the same time, investment securities have the strength of the War Loan, now standing at 100, as a buttress against which to support their prices. Investors continue to absorb stock, regardless of French or other Continental excitements. The recent issue of Perak River Hydro Electric Power 5 per cents., one of the last to be made under the Trade Facilities Acts, proved a great success, the amount being substantially over-subscribed. The scrip was offered at 99½, and there is a premium of about ¼ on the allotments. This drew attention to the company's 7 per cent. participating debenture, the price of which went better to 91½.

Nothing fresh has occurred to conclude the suspense felt by the holders of shares in the various London electricity supply companies that have not yet announced their intentions with reference to the distribution of their reserves. The London Electric Supply Corporation has a meeting in the Wednesday of this week for the submission of resolutions authorising the alteration of the Articles of Association so as to permit of the capitalisation of undivided profits. County of London ordinary shares remain at 3½. Electric Supply Corporation shares are 9d. lower at 30s. 6d. Charing Cross ordinary gave way to 46s. 3d. The principal feature of strength is provided by City of London ordinary, where the price has jumped to 50s. 9d. Bournemouth & Poole, after being 3 1/16, went back to the previous price of 60s. 6d.

Underground Railway stocks are easier. After their big rises of last week, Districts and Metropolitans have both reacted. Underground Electrics are sixpence lower at 12s. 6d., though the company's income bonds at 102 show a gain of a point.

The cable stocks and shares are so quiet that the only change in the group is a rise of the fraction to 180¼ in Eastern Telegraph ordinary stock. An interesting personal note is the election of Vice-Admiral Grant to the directorate of the Western Telegraph Company. Marconis are tolerably active, though within fairly narrow limits, the prices ranging from 16s. to a little under 17s. Canadians have gone back to 3s. 9d. sellers.

Anglo-Argentine Tramways first and second preferences fell abruptly, upon reports to the effect that the City of Buenos Aires has promised to grant a concession for the construction of tube railways. It had generally been presumed that the Anglo-Argentine Tramways concession came in front of any other. On the other hand, there stands the well-known fact that relations between the Anglo-Argentine Tramways and the Municipality of Buenos Aires have been none too friendly for years past. The latter is accused of seldom allowing an opportunity to slip for letting the company understand that the City Fathers have the whip hand. A concession has been granted and published in the *Gazette*, Buenos Aires, for underground transport work. Anglo-Argentine Tramways 5 per cent. debenture stock is down 3 to 68½, making a fall of 6 points within a fortnight. Buenos Aires Lacroze consolidated mortgage 5 per cent. debentures, are nominally quoted about 63, but it is doubtful whether stock could be sold at anything like that figure.

Brazilian Tractions have been flat, owing to another fall in the value of the milreis. Fresh commotions in Mexico are responsible for the further weakness that has overtaken the prices of Mexican Light and Power and Mexico Tramway securities. Madras Electric Supply Corporation new ordinary shares have been dealt in this week for the first time. They were offered to the company's ordinary shareholders at 25s. 6d., and can be bought at 26s., free of stamp and fee. The first dividend will be paid next May, being the full final distribution for 1926. On the basis of the present paid dividend, the yield will work out, at 26s., to £6 3s. per cent., free of tax. The Lancashire Electric new issue of 7 per cent. preference shares will be made very shortly. About three million pounds of debenture stock is expected to be offered by the London Power Company, probably before the end of this week.

Pennsylvania Water and Power ordinary stock gained 2 points, rising to 175½, apart from which there has been little change in dollar securities.

Oriental Telephones, after their rise of 3s. 9d. last week, have lost 2s. 6d., at 2 7/16. The advance seemed rather abrupt, and had the effect of bringing in sellers. Telephone Manufacturing show a good deal of animation, the price being a little lower at 8s. 9d. There is not much doing in either Automatic or International Telephones. India Rubber shares came in for attention from Scottish buyers, and advanced to 22s. 6d.

Cromptons have been a bad market, falling to 10s. Business was done the other day at 8s. 9d. Siemens went better, to 29s. 6d., and British Aluminiums hardened to 47s. 6d., this being 1s. 9d. up on the week. The equipment and construction shares are steady. Brush drooped to 26s. 3d., as an exception to the generally firm disposition of the group. A fair amount of activity in Midland Counties new shares has left them a shade to the good at 20s. 6d. for ordinary and preference alike. Rubber shares keep dormant.

The unsatisfactory conclusion to the coal strike has failed to exert any marked effect upon iron, coal, engineering, and similar shares. Vickers rose to 9s. 4½d., but lost the pence. Babcocks, at 54s., maintain their improvement of a week ago.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Nov. 22 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1⅝	—	6 13 4
Charing Cross Ordinary	1	15	15	2⅛	−1/16	6 9 9
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	50/9	+2/6	5 18 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	3⅛	—	4 16 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30 6	−9d.	6 11 2
Kensington Ordinary	5	15	15	17	—	4 8 3
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	35/6	—	5 12 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	18½	—	4 14 7
South London	1	15	15	2⅝	—	5 14 3
South Metropolitan Pref.	1	7	7	1⅝	—	5 12 0
Urban Ordinary	1	4	7	1⅝	—	5 12 0
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	2⅛	—	7 5 5
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	62	−1	8 1 4
do. District	,,	3½	3½	37	−1½	6 2 10
Underground Electric	£1	Nil	Nil	12/6	−6d.	Nil
do. do. Income ...	Bonds	6	6	102	+1	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	24¾	—	6 1 3
Automatic Telephone	1	3	10	2⅝	—	3 9 7
Chili Telephone	5	5	6	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅛	—	7 0 4
Eastern Extension	10	10	10	18½	—	*5 10 4
Eastern Tel. Ord.	Stock	10	10	180½	+½	*5 10 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 8
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅞	—	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	2 7/16	−⅛	*4 18 4
United R. Plate Tel.	5	8	8	7 3/8	—	*5 2 5
Western Telegraph	10	10	10	17½	—	*5 13 8

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	21½	−⅛	9 15 6
do. do. 2nd Pref. ...	5	6	6	2¼	−⅛	11 8 2
do. do. 5% Deb. ...	Stock	5	5	68½	−3	7 6 0
British Electric Traction Ord. ...	,,	7	8	144½	−½	5 10 9
do. do. 6% Pref. ...	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	105	−3½	4 15 3
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	86½	—	5 15 7
do. do. Preferred ...	,,	9/-	12/9	116½	+1½	*5 11 7
do. do. Deferred ...	,,	12/5	8	145	—	*5 10 4
do. do. Deb. ...	,,	4½	4½	76½	+½	5 11 1
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	65½	−1	7 12 8
Mexican Light Common	100	Nil	Nil	32½	−3	Nil
do. Pref.	100	Nil	Nil	77½	−2½	Nil
do. 1st Bonds	—	5	5	65½	−1	7 12 8
Yorkshire (West Riding)	1	5	—	12/6	+1/-	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	54/-	—	4 12 10
British Aluminium Ord.	1	5	10	47 6	+1/9	4 4 3
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	8⅝	—	4 8 11
Brush Ord.	1	10	10	26/3	−9d.	7 12 4
Callenders	1	15	15	8½	—	4 12 4
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	−2/-	... ...
Edison-Swan	£/-	10	10	12/9	—	8 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	32/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1⅛	—	6 6 4
English Electric	1	5	Nil	14/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	2 1/-	—	5 18 1
do. Ord.	1	5	7½	29/6	—	5 1 8
Henley	1	16	20	4	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	+1/8	*4 9 0
Johnson & Phillips	1	10	17½	55/-	—	6 0 2
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	2	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	29/6xd + 9d.		5 1 8
Telegraph Construction	12	20	10	20½	—	*4 1 4

*Dividends paid free of Income Tax.

Some Electrical Problems.

Two New Traction Systems—High-Voltage, Direct-current Transmission.

By W. W. E. FRENCH.

(Abstract of Chairman's Address delivered at Leeds, before the NORTH MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

GREAT Britain's immediate problems are both agricultural and industrial, for we are not at the present time tendering sufficient wealth by the export of manufactured goods to pay for the food of the people, and for the requisite raw materials. We must, therefore, vigorously recruit all our resources and apply all our knowledge to increase the productivity of our manufacturing and agricultural industries.

The universal supply of electricity at low charges will initiate the decentralisation of and ruralise industries; the small cost of ground, the low rates, the smaller cost of living in rural districts, will all combine to reduce overhead charges and will assist the manufacturer to produce at competitive prices. With electricity as motive power, decentralisation of the factory itself is quite conceivable. From such a process emerges the small master-owner who would make certain standard articles which are integral parts of machines to be erected in a central establishment. It would tend to re-establish "home industries" in the old-fashioned sense.

The moral effect of such a position is almost incalculable. Much of the discontent and dissatisfaction of the modern artisan lies in his conviction that, individually, he is a very small cog in a very large machine, and that his advancement is strictly limited. Remove this conviction, and, given the possibility of attaining to industrial small ownership, his outlook on life would undergo a complete change, much to his own advantage and to the well-being of the whole community.

Practically all labour leaders in this country and abroad are staunch supporters of electricity supply on the large scale. The reason for this attitude is the universal experience that the introduction of electricity supply, or its intensification in any district or country, has been accompanied by a substantial reduction of unemployment. Another factor which may have had some bearing on the labour attitude towards electricity power supply is indicated by the following figures: In the U.S.A. the specific intensity of electricity supply is about 3.3 h.p. per workman; in Great Britain it is approximately 50 per cent., and in Japan 25 per cent. of that of the U.S.A. The average wages paid in the U.S.A. are approximately double those paid here, and roughly four times as large as those paid in Japan. While it would be inadvisable to generalise, yet there appears to be a direct and nearly proportional relation between the specific intensity of supply and wages earned, and it is certainly right to insist that intense electrification will be followed by increased productivity and wage-earning capacity of labour, and that national electrification will inaugurate a phase of national prosperity.

The most basic and most neglected of our industries—agriculture—must enjoy, as all other industries do, the benefit of an abundant and cheap supply of electric power, which must become available with the least possible delay. The agricultural industries must be placed economically and technically in such a position that they can participate in the future to a much greater extent in the responsibility of tendering the nation's food supplies, a responsibility which, up to the present, has had to be borne by the manufacturing industries alone.

Traction.—Electrical development for agricultural purposes must necessarily be slow and laborious; here electric main-line traction can be of particular service in providing the countryside with a system of transmission lines, which become immediately lucrative by virtue of the traction load.

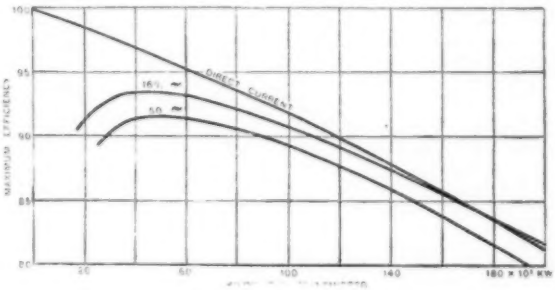
The engineering opinion of the past decade has decided in favour of the d.c. system, yet during the past three years new a.c. systems have sprung up which are likely to reopen discussion on this problem. One is the Kandos system now under trial on the Hungarian railways. Since it is not generally known, it may be stated that the supply to the locomotive is single-phase at high voltage, 50 cycles, and the drive is by three-phase motors; as an intermediary, a phase-convertor of peculiar design is employed; it is a combined single-phase motor and a three-phase generator, each possessing a separate system of windings on a common stator, excited by a common field. Single-phase energy taken from the overhead wire drives the phase-convertor as a single-phase synchronous motor; the rotating d.c. field system also excites the three-phase generator, which, in turn, supplies the energy to three-phase induction motors. The small exciter is not a constant-voltage machine, and is arranged for automatic voltage regulation so that the voltage from the three-phase generator varies approximately as the square root of the motor load, thus ensuring that the motors work at terminal voltages conducive to maximum efficiency. Simultaneously, the alteration of the field values effects a correction of the power factor of the motors, relieving the trolley system of idle kVA.

A second machine has recently been developed by Messrs. F. Krupp (Essen); it is a single-phase induction motor developed expressly for traction purposes, its characteristic feature being an intermediary, or auxiliary, rotor with a squirrel-cage winding and a separate excitation winding which is usually energised by direct current, but may be excited by very low-frequency three-phase currents. The intermediary rotor is not intended for energy transmission, and spins on the shaft of the main rotor; its main functions are to eliminate the inverse field by means of the squirrel-cage winding, and to assist in the motor's magnetisation with a view to power-factor compensation. As the intermediary rotor does not transmit energy, its magnetic axis will align with that of the stator and leading-current components result in the stator winding, effecting any required compensation according to the value of the d.c. excitation of the auxiliary rotor. Owing to the elimination of the inverse field, the main or working rotor itself experiences a uniform rotating field, with the result that this motor can be used in cascade connection with normal three-phase induction motors for speed regulation.

Transmission.—The invention of the Transvertor has placed the problem of the transmission of electrical energy by means of high-voltage direct current in the sphere of practical politics.

I have produced a set of curves (below) given by Ossana (*E.T.Z.*, 1922), in which maxima transmission efficiencies are plotted against transmitted kW, for direct current and for alternating current at 50 and 16⅔ cycles. The transmission distance is 100 km. and the transmission pressure 220 kV in all cases; it is assumed that two reactances are used for the 50-period current to compensate for the capacity effects of the line.

According to these curves there appears to be no case for the superiority claim of high-voltage direct current, except at the lower loads transmitted; at any rate, the advantage gained does not seem to warrant the complications involved in its



Efficiency-Transmission Curves.

generation or conversion. The criticism, however, which can be levelled against these curves is that they are based on comparisons between effective a.c. and effective d.c. voltages. When assessing the merits of the two systems it is obviously necessary to compare the effective d.c. with $\sqrt{2}$ of the effective a.c., and neglecting to do so completely ignores the importance of the relative cost of copper and insulation in high-pressure work. In such cases the cost of insulation far outweighs the cost of copper in cables, and with high-voltage overhead transmission the cost increases rapidly with the voltage; when the systems are compared on the basis of the same maximum voltages, it immediately becomes clear that twice the power can be transmitted by direct current, assuming the same weight of copper and the same losses in both cases. In reality, the conditions are much more favourable, and Mr. W. E. Highfield states that the safe direct-current pressure is at lease twice as great as any alternating-current pressure which may be used in the same insulator and the same cable. M. Delon's tests on underground cables, working at 45,000 volts alternating current, show that the pressure could be raised to 150,000 volts when subjected to direct current, which is more than three times the effective alternating voltage.

Accepting, however, Mr. Highfield's conservative figure, then four times the power can be transmitted by the high-voltage d.c. system over the same line with the same transmission losses, neglecting altogether corona losses, capacity and inductance effects, power factor and its correction. If these were included, coupled with the possibility of an earth return (which is not permissible with three-phase transmission) the argument is overwhelming in favour of high-voltage direct-current transmission: its advantages are briefly summarised as follows: It will be possible to produce at a reasonable cost cables which, at the present moment, are only practicable for high-voltage overhead transmission, and cable transmission becomes economically possible. The great importance of this in densely populated areas needs no emphasis. A similar

economy can be shown to exist with overhead transmission, and there can be little doubt that the lines for d.c. transmission must be much cheaper and simpler.

Electrical Manufacture.—The struggle for the world's market of manufactured goods has become the deep concern of every European country. Granted an abundant supply of cheap electric power, the solution would lie in heavy specialisation and the standardisation of definite articles, types of machines, or apparatus, in individual or groups of factories by mutual agreement. This process can already be observed in the amalgamation of large firms of like and similar interests, and in smaller firms concentrating on the manufacture of one kind of apparatus, machine, or line of machines. If this principle could be extended on a national basis and by mutual agreement in the manufacturing industries, immense benefits would accrue individually and nationally. Such reorganisation could not be accomplished without the aid of a standing Committee to act in an advisory and co-ordinating capacity, and to promote agreement regarding desired and suitable specialisation within the manufacturing industries. Its membership could be recruited from such representative organisations as the British Electrical and Allied Manufacturers' Association, the British Engineering Standards Association, and the British Electrical Development Association.

Fuel.—Reviewing the subject of coal utilisation, it seems essential that power development should begin with coal carbonisation and by-product recovery. The gas industries would be charged with this process, and the sale of the gaseous and other products. The electricity supply industries would then take over the consumption of the solid fuels in the form of coke for power production; thus would their national economic value be further enhanced and strengthened.

Electricity in Coal Mines.

(*Abstract of an address before the London Branch of the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

SOME interesting figures relating to the electricity-supply and coal-mining industries, which go to demonstrate the interdependence of the one industry upon the other, were given by Mr. W. F. Bishop in his presidential address to the London branch of the Association of Mining Electrical Engineers on Tuesday, November 9th.

In the first place, Mr. Bishop dealt with the Electricity (Supply) Bill, which is now before Parliament, and said that the average consumption of coal, 2.4 lb. per kW-hour, was a long way from the best results obtainable, as in many up-to-date stations a figure below 1.5 lb. had been obtained. At a first glance one would say that it would affect the coal-mining industry adversely, because it would reduce the demand for coal; but he suggested that the opposite would be the case, because he foresaw that the demand for electricity, because it would be cheaper and available in areas not at present supplied, would increase at a greater rate than that at which the improvement in methods of generation would reduce the quantity of coal per kWh generated. The quantity of coal consumed per kWh was reduced by approximately 25 per cent. in 1924-25 as compared with 1920-21, but the coal consumed increased by 9 per cent., owing to the fact that the units generated increased by nearly 45 per cent. This cheaper supply of electricity would also benefit manufacturers generally and thus stimulate the demand for coal for other purposes, such as transport, steam-raising for factory process work, &c.

Dealing with reorganisation of the mines, Mr. Bishop confined himself to reorganisation by the increased use of electricity, and gave figures to support his contention that much remained to be done in this direction. One of the greatest difficulties in the way of increasing the use of electricity in the mines in the past had been the financial one. Not only had the cost of the apparatus to be found, but probably also the heavy capital cost of installing generating plant. The development of electricity supply under the new Bill would help the mining industry in this respect by making a reliable source of power available at a price lower than that at which a comparatively small colliery generating plant could supply, and in saving the colliery the heavy capital expenditure required to install the necessary generating plant and to keep it up to date. Such capital could very often be more usefully employed in increasing the electrical equipment of the colliery, at the same time adding to the electric power station a very valuable load owing to the high load factor of mining equipment. The question of electric winding also assumed another aspect under these circumstances. In a generating station supplying an individual mine, the load where electric winders were installed was very variable, and the peak load very high, compared with the average, but in the case of a large generating station, such as those visualised under the Electricity Bill, with a wide area of distribution and a wide variety of demand, the diversity factor would be much better, the winding load would be dealt with without unduly affecting the load factor, and, owing to the large generating units and large amount of power behind the modern system, the effect of the switching on or off of, say, a 1,500-h.p. winder would be unnoticeable. Another great advantage was that the colliery would be able to call for a large or small amount of power as occasion arose, so avoiding the necessity for keeping generating plant running at holiday times and week-ends. Also, the fact that the power was available, would render it much easier to put electrical plant into use, as the big question of an increase in the generating plant would not have to be faced at the same time. These remarks did not apply to some of the large groups of collieries, where power was generated at large and efficient stations and distributed over a considerable area to many mines, in some cases being connected also to the public supply mains.

The total quantity of coal raised in 1924 was 267 million tons, of which 16¼ million tons was used in the collieries themselves as engine fuel, and 6¼ million tons was used as miners' coal. Only about 11 per cent. of the total of 267 million tons was cut by electrically-operated machines, and only 18.7 per cent. by machines of all types in 1924, this being an increase of 50 per cent., however, as compared with 1919. The number of electrical coal-cutting machines in use in 1924 was 3,044, and 3,783 machines were driven by compressed air. These were in use in 908 mines out of a total of 2,855. Only 1,630, or 57 per cent., of the mines had electrical equipment installed, with a total horse-power of 1,482,000, or 1 h.p. for every 180 tons raised per annum, 811,000 h.p. being below ground and 671,000 h.p. above.

If the 16¼ million tons used by the collieries themselves were expressed in the form of electrical energy at the rate of 1½ lb. of coal per kWh, it would be found that it allowed approximately 100 kWh per ton for the 267 million tons raised—ignoring the fact that some of that was already raised by electrical means. The highest estimated figure the author had been able to find of the electrical power required to raise one ton of coal was 50 kWh, and the lowest about 7 kWh, depending on the local conditions in each case. Even on the highest estimate, some eight million tons of coal would be made available annually for sale if the whole of the output were raised electrically by current generated with 1½ lb. of coal per kW-hour, the value of which would go a very long way towards installing the most up-to-date electrical equipment in all the mines.

Mining electrical engineers could help future development by pressing forward the increased use of electric power in the collieries, for which there was a big field, particularly in the direction of coal-cutting, conveying and haulage, and winding, as well as in a direction to which little reference appeared to have been made, namely, the improvement of the lighting of underground workings. He had found no reference to that subject in the annual report of the Safety in Mines Research Board, and only a short reference in the report of H.M. Chief Inspector of Mines, in which it was stated that better lighting should tend to reduce underground haulage accidents, particularly at landings, pass-byes, and junctions. Mr. Bishop suggested that still greater improvement would be effected by greatly increasing the wattage and the number of lamps employed, for it had been recognised for many years in factory work that improved scientific lighting did effect a great improvement in output and a reduction of accidents. The average degree of lighting employed underground was far below that which was accepted as good practice in modern factories, but with electricity available there was no reason why underground workings should not be efficiently illuminated. Electric lighting was cheap, and the increased cost would, he felt sure, be amply repaid by the increased safety of the miners and the increased production that would be effected.

Mr. J. W. GIBSON (past branch president) gave some figures of the results achieved in some of the large power stations and collieries in America, which he had recently visited. At one station they were generating on a high load factor at 15,000 B.th.u. per kWh. this being the average figure for a month, and at another station the figure was 15,700. These were stations with five or six 45,000-kW machines. At another station they were putting down the foundations of an 80,000-kW machine, and in another case an order had been placed for a generator of 150,000 kW capacity. One of the most interesting pieces of mining apparatus he had seen was a 60-h.p. underground locomotive with a height above the rail of 30 in. It was operated either by trolley or by storage battery. There was other electrically-driven apparatus, such as coal conveyors, coal cutters, automatic fillers for long-wall working, and so on, while in some mines it was difficult to find underground any machinery that was not electrically driven. Discussing the economies to be obtained by the greater use of electricity in this country, he said that if all the power-driven machinery used in industry were driven by electric power supplied through super-power stations there would be a saving of nearly a million tons of coal per annum.

Mr. HUMPHREY MORGANS, supporting a vote of thanks to the branch president, expressed the view that there was still something to be said for the small station, and pointed out that it would put a tremendous power into the hands of Labour; for instance, if they managed to get one of the big stations shut down. Again, a good deal of rubbishy coal, which would not bear the cost of transport, was at present used where it was won, and with the advent of the super power stations it was difficult to see what could be done with that material.

The Situation in China.

MR. A. H. GEORGE, Acting Commercial Secretary at Shanghai, has prepared for the Department of Overseas Trade a report upon the commercial, industrial and economic situation in China up to June 30th last.* In a general survey Mr. George refers to the boycott of British goods and says that while this has been relaxed in north and central China, it continues in the south, particularly at Canton and Swatow. In Shanghai, where the boycott originated, there is little or no hindrance to trade from this cause, although labour in local industries is troublesome. At the date of the report there was still no effective central administration and the disorganisation of government had reached an unprecedented pitch. One undesirable outcome of the military activities has been the imposition of countless forms of local taxation and the privileges accorded to foreign trade under treaties and agreements are at the mercy of the military leaders; it is surprising that the results have not been more serious than has been the case. It is pointed out, however, that trade is still being carried on and that the political disorders are mostly local and rarely involve the whole country at once. Moreover, a large proportion of the trade is carried out through the so-called treaty ports where there is comparative stability and the present demand for foreign goods is in the nature of an irreducible minimum. There is likely to be an immediate increase in foreign trade with any improvement in conditions. A very serious feature of the disturbances has been the virtual suspension of the bulk of the railways.

Industry and Trade.

Under normal peaceful conditions there is no doubt that modern factory production in China would rapidly develop, but the period reviewed witnessed small progress. Labour agitation is constantly on the increase and the purchasing capacity of the people has been considerably lowered. Industrialists also feel the burden of high capital charges, being forced to borrow money from the banks at high rates of interest. This leads them to the cheapest market when considering the purchase of machinery, and forms a handicap to British manufacturers. Another point is that labour-saving machinery is not looked upon as being very important owing to the cheapness of labour. One Chinese industry which showed progress during 1925 was that of electric lamp making. The value of exports was three times the previous year's figure.

The report says that in spite of the civil dissensions inquiries for machinery have been continuous; many orders have been placed and British manufacturers have received a fair share of them. Many of the large orders for electric lighting plant have gone to Swiss manufacturers; the remainder of the business has been secured mainly by British or German firms. A number of orders have been placed for turbo-alternators. British manufacturers have obtained orders for a 20,000-kW set for the Shanghai Municipal Council, and a 3,000-kW set for the Mukden Arsenal. A 5,000-kW set was ordered by Canton from American suppliers, British manufacturers not being asked to quote on account of the boycott, though it is understood that a part of the machinery supplied was of British manufacture. An order for a 750-kW set for a city below Hankow on the Yangtze was secured by American manufacturers, whose agents are reported to have agreed to guarantees and terms of payment which were not acceptable to British firms. These contracts involve the purchase of corresponding boiler plant, and most of the orders for such plant go to British makers. There has been a good demand for electrical meters, and substantial orders for supply companies in various parts of China have been executed by British manufacturers. A certain number of large transformers have also been ordered from British firms. There is a large sale of American fans, for which business American manufacturers have obtained a strong hold on the market. One British company is bidding for this business. There has been a good demand for British oil engines, which, owing to their excellent design and competitive prices, are displacing German and American types. The native-manufactured and German engines are, however, serious competitors. An increased demand for small refrigerating plant has been met by American manufacturers, who make a special study of Chinese requirements and do a good deal of propaganda work. The total value of machinery imported for electric power stations during 1925 was 858, 151 Haikwan taels; in 1924 the figure was 807,581 taels, and in 1923 1,516,259 taels (tael = about 3s. 6d.). Electrical materials and fittings were of greater importance, the imports being valued at 6,890,076 taels in 1925 and 8,194,962 taels in 1924.

Hints to Traders.

One section of the report, as is usual, is devoted to advice to merchants and manufacturers who desire to do business in China. These are cautioned against entering into transactions with unknown Chinese firms. Owing to the difficulty of securing information respecting the standing of firms and in securing redress in the event of a dispute arising, it is still safer to do business only through reputable British or other foreign firms in the country. Those desirous of obtaining information as to the standing of any firm of importance in China, whether native or foreign, can frequently do so through the London offices of the Far Eastern banks, or in the case of necessity an inquiry through the Department of Overseas Trade may secure the necessary particulars.

* Stationery Office, 2s. net.

Some Economic Problems.

Labour and the Natural Resources of Great Britain.

By Col. J. F. LISTER, C.M.G., M.I.E.E.

Abstract of Chairman's address delivered at Birmingham before the SOUTH-MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

OUR export trade declined in 1924 to three-quarters of its pre-war volume, chiefly owing to the high prices we require for our goods, as compared with prices ruling in 1913, the result being that overseas buyers are diverting their attention from British to other markets. We must remember that the conditions of living in this country are of no interest whatever to foreign buyers, or Home buyers for that matter. How many people, when buying an article, stop to think of the conditions under which it was made? Export trade is essential to us, because we depend upon our exports to pay for certain raw materials; we can only produce enough food for 2¼ days in the week, and about a quarter of our land is unproductive. Our Colonies are becoming more independent of us; necessity being the mother of invention, they learnt during the war how to make, or substitute, other goods for those previously obtained from this country, and this policy will doubtless continue—all of which tends to lessen the demand for our manufactures, with consequent more unemployment. How can we *reduce* the cost of our goods?

Before dealing with the individual workman, or what we may accomplish by cheaper power (a large factor), consider the enormous burdens we have to bear for central and local Government affairs. However desirable different schemes may be, we have reached a point from which we can go no further. Little consideration seems to be given to what we can afford, and we should not call on our workpeople for greater effort unless we are sure that the monetary gain to the country thereby is not wasted.

Are we making the best possible use of the resources of this country? We have no water power of any extent, and the initial outlay of making use of tidal rivers, at all events for the present, puts such schemes out of the realm of commercial possibility. Much coal has been made marketable by foreign colliery owners by a scientific system of washing, grading, and classification, so that buyers know in advance that the quality is consistent, that it is uniform in size, and altogether similar to that specified; but there does not appear to be a great desire on the part of British colliery owners to sell fuel on analysis, *i.e.*, on a calorific basis, and be paid on a sliding scale accordingly. The undoubted advantages of washed fuel with the lowest possible ash content is now recognised, as the transport of ashes and clinkers is a very expensive problem for large consumers. Let us hope that the good policies and methods adopted by foreigners will not be ignored by progressive collieries in this country. When low-temperature distillation processes are a commercial success, it will doubtless be found possible to pulverise coke and use it in many cases in place of coal. This will result in valuable by-products being produced, a closer linking-up of electricity and gas undertakings, and eventually a great saving in our irreplaceable natural asset—coal.

Although the Electricity Bill has been framed with a big outlook, it cannot be said to meet with universal approval. The price which a consumer pays for electricity depends on capital charges, and it is significant that in America, where hydro-electric stations supply a fairly large demand, their principle costs of generation are standing or overhead charges, and the average price to consumers exceeds the average price per kWh in this country. The advantages of centralised power production are much greater where coal is dear than in our country where it is relatively cheap.

There are some people who think that cheap electricity will be the salvation of this country, and that the substitution of the State for private or municipal enterprise is going to save our industries. To my mind, what is more important is some means of settling the endless labour disputes which have taken place during the last few years, or, better still, *preventing their occurrence*. Some 500 odd disputes were settled in 1925, and it is impossible to calculate the direct and indirect losses due to industrial unrest. I think disputes are better dealt with, as regards settlement, by the parties concerned. Profit-sharing and labour co-partnership in industry, good as such schemes may be, are not a solution of the problem of industrial unrest. Profit-sharing schemes, if treated seriously by workpeople, doubtless tend to unite all departments, prevent friction, and to economy all round, but they will never replace payment by result of individual effort in the form of bonus schemes, &c.

If we can so organise our industries that our workers can earn good wages, and also benefit by profit-sharing schemes, they will then be able to invest their savings in industry itself, which, I think, would do more than all discussion to settle the endless disputes between Capital and Labour. We should teach our workpeople to think for themselves; they must realise that the remedy is partly with themselves, but we must not throw the entire burden of greater production on the workmen; he must be assisted by labour-saving appliances and have confidence that whatever he is working on is in no way behind our foreign rivals in design. The cultivation of personal relations between management and men will create a better spirit between employers and employés

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A Heavy-Machinery Vehicle.

A new motor vehicle which has recently been supplied to the YORKSHIRE ELECTRIC POWER CO., LTD., by the ASSOCIATED DAIMLER CO., LTD., Blackhorse Lane, Walthamstow, London, E.17, has some novel and interesting features. It was designed specially for the Y.E.P. Co., for the purpose of facilitating the transport of heavy electrical machinery. The vehicle, fig. 1, is constructed on a model 507 Associated Daimler 6-ton chassis, an extended platform being provided at the tail. A winch is fitted just behind the driver's cab and is chain-driven from a gear wheel which is worm-driven from the engine gearing. Two 12-ft. ramps, up which the machinery to be transported is hauled by the winch, are provided at the end of the tail; these are light, but are trussed so as to allow them to carry heavy weights. Two screwjacks are used to support the overhang of the body during loading and unloading. The height of the body from the ground is 2 ft. 10 in., and the floor consists of steel-stiffened oak planks directly fitted on to the chassis frame.

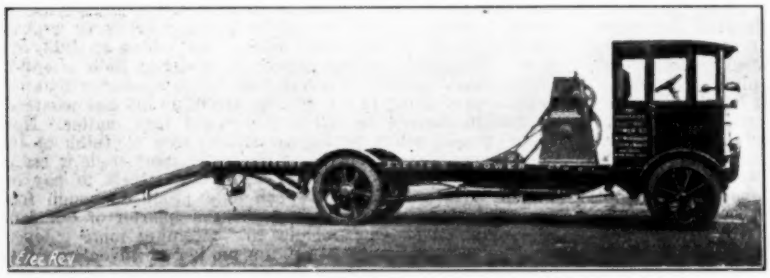


Fig. 1.—Specially-designed Y.E.P. Co. Vehicle.

A New Outdoor Fuse.

One of the latest American productions is a novel outdoor fuse, "Disconnects," which has been introduced by the ELECTRICAL ENGINEERS EQUIPMENT COMPANY of Chicago. The distinctive feature of the equipment is a detachable fuse holder, which can be removed from and replaced in the mountings by using a switch hook with a special detaching prong. Fig. 3 shows the device with a switch hook engaged in the fuse holder just being removed from the mountings. The fuses are built on standard pin insulators for voltages from 7,500 to 73,000 and are available in capacities up to 75 A. The fuse link used in connection with this device is enclosed in a live rubber tube which protects the porcelain tube from the heat of the fuse wire. It also absorbs some of the mechanical shock caused by the fuse being ruptured by heavy currents. When the

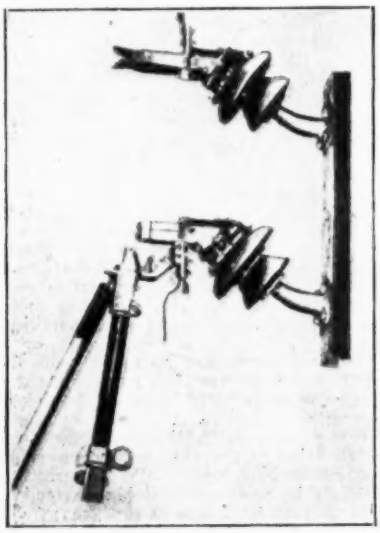


Fig. 3. Detachable Overhead Fuse.

fuse operates the rubber tube is expelled, taking with it all of the molten fuse metal and practically all of the charred portions caused by the electric arc, thus preventing the inside of the tube from becoming coated with any of the conducting material formed.

Tests on this fuse show it to be capable, it is claimed, of successfully interrupting short-circuit capacities varying from 5,000 kVA to 16,000 kVA. The fuse is made in two types, FV, in which the insulator units are inclined upward at 55 deg., fig. 3, and FVH, with the insulators placed at 90 deg. to the base. All the parts except the insulator units are interchangeable.

A Four-way Plug-in Dice.

What is known as a four-way plug-in die, fig. 2, has lately been put on the market by a German firm. The device is intended for use on the tea or dinner table so that four units, for instance, an electric kettle, toaster, and cigar lighter, in addition to a table lamp, can be brought into use at the same time.

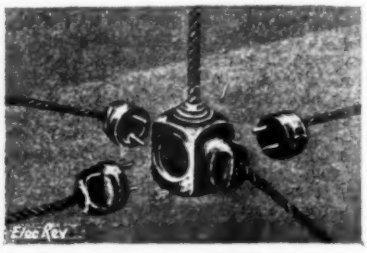


Fig. 2.—Four-way Die.

A Bi-Focal Automobile Lamp.

The accompanying illustration, fig. 4, shows the Osram bi-focal automobile lamp, which has recently been developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, for use in connection with the anti-dazzle headlamps fitted to most modern American cars. It has been introduced to overcome the effect produced by the springing of the car on a rough road, and the elevation of the beam produced when cresting a hill. The lamp is gas-filled, and has two filaments of exactly the same wattage, one of which is located at the focal point of the reflector, and

Fig. 4.—Bi-Focal Lamp.

the other above the focal point. The effect of the latter is to "dip" the beam. The two filaments are controlled by a change-over switch. In order to prevent the creation of false images of the filament by internal reflection from the glass surface of the bulb, the front portion of the bulb is corrugated so as to break the reflection. It is necessary to note that the lamp in itself does not constitute an anti-dazzle device, and can only be used in certain types of American headlamps, for which it is specially designed, and on cars equipped for twin-filament lamps. The lamp is at present supplied in one size only, 6-7 V, 18 W.

An Electrically-Controlled Valve System.

We have received some particulars of a new system of valve control for internal combustion engines which has been invented by Mr. L. N. BLAND, of Australia, whose temporary address in this country is 20, Edith Villas, London, W.14. The control is by electro-mechanical means, the valves being operated by solenoids which are supplied with current at the correct times and sequence by means of a rotary distributor equipped with brushes mounted on fulcrumed arms. Two sets of brushes are provided, one at each end of the arms, thereby permitting, it is claimed, easy reversion of the engine. The apparatus for each cylinder is arranged as a separate unit and controlled by a switch. The timing is effected by means of metal strips of suitable lengths mounted on the periphery of the rotary unit, the brushes making contact with the strips as these pass under them. The running direction is controlled by a single lever and both sets of brushes can be lifted clear of the drum to put the engine out of action. The supply for the solenoids is received from a small generator or other source of supply. Among the other advantages claimed for this system are: The elimination of cam apparatus and its frictional losses; saving in the cost of construction and assembly, and the overall weight of the engine; simplicity of control; and increased efficiency.

Electric Locomotives.

A Method of Comparing their Characteristics.

By T. A. F. STONE, of the North-Western Railway, Lahore, India.

(*Abstract of Paper read before the* INSTITUTION OF MECHANICAL ENGINEERS.)

This paper deals with a method by which electric locomotives as well as steam-locomotives can be classified into types on a common basis, so that their characteristics can be analysed and compared and their respective merits deduced.

For the purpose of this investigation, the following characteristics have been chosen common to both systems as being the most suitable :—

HP=The average horse-power, which has been taken as equal to 20 times the grate area in square feet for the steam locos and equal to the one-hour horse-power rating for the electric locos.

A=The adhesive weight in tons of the locomotives when in working order.

E=The weight in tons of the motive power equipment which, for the steam loco, includes the weight of the boiler, water, coal, steam-pipes, cylinders, pistons, piston-rods and motion and for the electric loco includes the weights of the motors and the electrical equipment.

W=The weight in tons of the locomotives in working order.

The absolute values of the above characteristics are useless for comparing steam and electric locomotives, but their relative values or "ratios" between them give the required basis of comparison. For instance, the ratio HP/A bears typical values for passenger engines, other typical values for goods engines, and still other typical values for shunting engines. Further, these typical values are different in the case of steam locos from what they are in the case of electric locos, as will be shown later.

In order to carry out his investigations, the author collected data regarding some 92 steam and electric locomotives, classified them and calculated the values of the characteristics, as well as the values of the various ratios subsisting between them. An abstract of the results is tabulated below.

Average Values of Ratios HP/A, HP/W *and* A/W *for Steam and Electric Locomotives.*

Type of loco.	Steam.			Electric (average).		
	HP/A	HP/W	A/W	HP/A	HP/W	A/W
Passenger ...	15.4	5.67	0.375	30.89	22.99	0.753
Goods.	10.96	5.70	0.528	19.18	18.24	0.940
Suburban motor coach	12.37	4.18	0.337	13.59	11.15	0.79
Shunting	9.03	6.31	0.701	11.15	10.32	1

Only three of the ratios have been shown in the above table in order to make the issues more clear. It will be noted that the three ratios chosen are higher in every case for the electric locos than for the steam locos of the same type; also the ratio HP/A is highest for the higher-speed passenger locos and lowest for the lower-speed shunting locos (both steam and electric). In other words, the ratio HP/A is a measure of the speed for which the locomotive is designed, a fact which can be reasoned out.

In the same way it is shown that the other five ratios bear typical values for steam and electric passenger, goods, and shunting locos.

The following conclusions are drawn :—

(1) That the horse-power per ton of adhesive weight is much higher for electric than for steam locos of the same type.

(2) That the horse-power per ton of electric equipment for the electric locos is much higher than the horse-power per ton of steam equipment for the steam loco.

(3) That the horse-power per ton of total weight in working order is much higher for electric than for steam locos of the same type.

(4) That the weight of the electric equipment is approximately the same as the weight of the steam equipment for locomotives of the same total weight.

(5) That for locomotives of the same adhesive weight, the weight of the electric equipment is much less than that of the steam equipment.

(6) That passenger electric locos have the greatest value of the ratios HP/A, HP/W and E/A, and the least value of the ratio A/W, as compared with electric goods and shunting locos, whether direct-current, single-phase, or three-phase.

(7) That shunting electric locos have the least value of the ratios HP/A, HP/W and HP/E, and the greatest value of the ratio A/W as compared with electric passenger and goods locos, whether direct-current, single-phase, or three-phase.

(8) Electric motor coaches have the least values of the ratios E/W and E/A of all the types considered, whether direct-current, single-phase, or three-phase.

(9) Electric goods locos have ratios intermediate in value between those of passenger and shunting locos.

(10) That of the electric loco types the ratios for the single-phase system most resemble those of the steam, and the ratios for the three-phase system least resemble those of steam locos. Thus the determination and classification of the above ratios for any steam or electric locomotive furnish a method of identifying its type or sphere of utility.

Comparison of Characteristics.—Having evolved a common basis of classifying electric and steam locomotives into various types, to determine their sphere of utility, the author proceeds to analyse the characteristic ratios and to deduce therefrom the respective merits of steam, single-phase, direct-current, and three-phase locomotives.

It is assumed that a number of hypothetical locomotives have to be designed, one of each type, with the same wheel arrangement (0-4-4-0) type, the same adhesive weight, 40 tons, and the same axle-load of 10 tons. The starting tractive effort is assumed to be the same for each and equal to the adhesive weight/4=22,400 lb.; the duty to be performed in each case is to haul a trailing train load of 115 tons up a 3 per cent. grade at a speed of 16 miles per hour.

The tractive effort at this speed for this duty will be=11,720 lb., and the horse-power 500.

The above arbitrary assumptions in actual practice would not be the same for all the locomotives, owing to their widely different characteristics.

The following conclusions are drawn :—

(A) *Types of Locomotives.*

(1) Passenger locomotives have the highest values of the ratios HP/A, HP/E, HP/W, and E/A, and the lowest values of the ratio A/W.

(2) Shunting locomotives have the highest values of the ratio A/W and the lowest values of the ratios HP/A, HP/E and HP/W.

(3) Motor coaches have the lowest values of the ratio E/W.

(4) Goods locomotives have intermediate values for all ratios.

(B) *Types of Motive Power.*

(1) The 3-phase electric loco. has the greatest maximum horse-power, the highest critical speed, greatest accelerating force start to full speed and the least range of economical speeds, the highest values of the ratios HP/A, HP/E, HP/W and A/W, and the lowest value of the ratio E/A.

(2) The steam loco. has the least maximum horse-power, lowest critical speed, least accelerating power start to full speed and the greatest range of economical speeds. It has the highest value of the ratio E/A, and the lowest values of the ratios HP/A, HP/E, HP/W, and A/W.

(3) The d.c. loco. has properties and ratios intermediate between steam and 3-phase locomotives, but closer to the latter.

(4) The s.p. loco. has properties and ratios intermediate between steam and 3-phase locomotives, but closer to the former.

Discussion.

Col. E. KITSON CLARK said the author might have admitted that the poor old steam locomotive carried its engine house on its back, whereas the electric locomotive very wisely left it far away. In the paper the average horse power had been taken as equal to 20 times the grate area in square feet for the steam locomotives; but Professor W. E. Dalby, in his book on "Steam Power," said that the average horse power was equal to 30 times the grate area in square feet for steam locos. Referring to the suggestion that two new types of electric locos. might be evolved in the near future, the high-speed express passenger and the fast goods electric loco., Col. Kitson Clarke emphasised the importance of operating a large volume of traffic in such a manner as to keep the lines clear, and said the time would come when long-distance goods and passenger engines would have to run almost at the same speed. The author's conclusion that the three-phase system had by far the highest value of all types, and the steam loco. by far the lowest, was an indication of the adaptability of the three-phase system to the requirements of a line in a crowded country.

Professor W. E. DALBY said that the author's statement that the horse-power per ton of adhesive weight was much higher for electric than for steam locos. of the same type meant that more horse power was needed to drive the electric tractor along than the steam loco., so that it was really a claim that it was less efficient than steam.

Mr. J. D. TWINBERROW, speaking of adapting steam locomotives to electrical working, pointed out that the boiler was an important structural feature, and if it were removed from the frame, and replaced by motors, the locomotive would be incapable of taking care of the stresses imposed upon it in practice.

Mr. J. CONNER did not think the comparison between the steam and electric locomotive could be a very close one, inasmuch as the steam locomotive was a self-contained unit, and the electric locomotive was a transformer of energy. The author had given the ratio of the weight of the electrical equipment to the weight of the locomotive as 46 per cent. in the case of the d.c. locomotive, but he believed this was rather high, and had found that the ratio was something like 33 per cent. There seemed to be some confusion in regard to this item in published records, however, because in some cases it had included parts such as compressors and exhausters—which were associated with the brake gear—as electrical equipment, and in one case that made a difference of 16 per cent. in the weight of the so-called electrical equipment. On the two principal lines in America they had single-phase transmission and converted on the locomotive, splitting the phases so as to drive three-phase motors. The fact that the necessary machine had to be provided washed out the claim that the three-phase equipment was lighter than the direct-current equipment. He regarded the figure of 33.9 h.p. per ton as the tractive capacity of the three-phase locomotive as overstating the case.

Hydro-Electric Power.

By Prof. F. BACON (Professor of Engineering, University College, Swansea).

(*Abstract of Chairman's address to the* SOUTH WALES BRANCH *of the* INSTITUTION OF MECHANICAL ENGINEERS.)

AN enormous sweep forward in hydro-electric engineering and the electrification of railways has been made by Switzerland during the last 16 years. She has already substituted hydro-electric power for steam to an extent which, reckoned per square mile of territory and per head of population, far outstrips the possibilities of any other nation. Still, only one quarter of her potential water-power has been developed. Now that electricity is laid on to over 95 per cent. of all the houses, and the steam engine is almost extinct, the saturation point of home consumption cannot be far distant; hydro-electric development, however, will not be arrested. The export of power to Italy, France, and Germany is already taking place on a considerable scale. Within another decade it is quite conceivable that Switzerland will be playing the part of power station to Central Europe to the extent of 10,000,000,000 kWh per annum. If sold in bulk at only 0.1d. per unit, the Swiss revenue would thereby benefit to the extent of about £4,000,000, or, say, £1 per head per annum. Thus, *per capita* it would be an asset to Switzerland comparable with what our export coal trade meant to us prior to the war.

Although engineers are transforming Switzerland into a huge power station of an ultimate capacity of some 8,000,000 horse power, the Alpine sculpture is on too vast a scale to suffer appreciable disfigurement. The fact is that Switzerland, though already a highly-industrialised country, is singularly free from man-made ugliness. Even buildings for purely industrial purposes rarely offend the eye. The æsthetic side is put last, but it is not lost sight of. This applies to machinery as well as buildings. Swiss engineers have been so active and successful that their country is now completely coupled up to a network of high-pressure lines fed by some 300 power stations, about 50 of which have an installed capacity of from 10,000 to 100,000 h.p. each. The total generating plant capacity amounts to nearly 2,000,000 h.p., and the annual output is no less than 1,000 kWh per head of population.

Switzerland is up against the storage-of-energy problem in a much more acute way than any other country in the world. Wherever power is derived from the combustion of fuel, man can regulate the combustion more or less to suit the demand for power. But Switzerland wants to live entirely on her native power from falling water. Nature decides when this shall occur, and her moods bear no relation to the habits of man. The Rhine refuses to flow full bore from 8 a.m. till noon and then knock off for lunch. The glaciers refuse to melt in the winter, which is the season of heaviest demand for light and heating. The hour-to-hour variation of load throughout the day and the discordant month-to-month variations throughout the year of both supply and demand call for power storage on a colossal scale. The Waeggital works is the latest and boldest attempt to solve the storage problem. The town of Zurich and the North-Eastern Power Co. of Switzerland have combined in an expenditure of over £3,000,000 to store water equivalent to about 50,000,000 kWh during the summer months for use in the winter. It has involved huge impounding works for creating a lake storing 140,000,000 tons of water at an elevation of about 1,500 ft. above the tail-race of the lower power station.

I shall deal with these works as a fine engineering feat. Whether they are a fine piece of economic folly I shall not discuss further than to mention that some Swiss engineers regard them in that light. It is amazing that in this enlightened age we are still without a neater substitute for a coal pile of 50,000 tons than that of an artificial lake high up in the mountains. It is humiliating that if there does not happen to be a convenient mountain handy with a large almost closed pocket within its fold the electrical energy we can release by burning 50,000 tons of coal in any ordinary steam power station cannot possibly be bottled up again for future use for six months or even six seconds. A cheap and neat solution of the storage of power comparable in its compactness with combustible fuel is one of the major engineering problems now pressing for solution.

Switzerland is the country hardest up against this problem of energy storing to-day; that may be our position to-morrow, for energy storage is the real crux of utilising tidal power. It cannot be said that British engineering has been stationary, even in the matter of hydro-electric engineering, for which the home demand is necessarily slight. Several British firms started hydro-electric departments at the conclusion of the war, and one of these has already built hydraulic turbines having an aggregate output of 250,000 h.p., including units both of impulse and reaction type larger than any I saw in Switzerland. This machinery has been shipped to such countries as India, South Africa, British Columbia, New Zealand, and Brazil. If the Severn barrage scheme matures (and the Government Committee charged with the investigation has just declared that it has established a *prima facie* case for it), we are promised 500,000 h.p. during a ten-hour day, or 30 per cent. more than the power generated by Niagara. This would render the Severn estuary more famous than Niagara or the Rhine, for it would be the first great conquest of tidal power. Recent progress in the design of high-speed water turbines of propeller and Kaplan type renders the project more feasible and justifiable than it was even five years ago; but as I have said before, we lack a cheap and neat method of storing energy. Indeed, in a flat, densely-populated country like ours, no known method is practicable on the scale needed. Perhaps the chemical engineer will find as satisfactory a way of doing this during the next 50 years as the electrical engineer has given us for transmitting and distributing power. Of one thing we may be certain—mechanical engineering will be even more indispensable than it is now.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity Bill.—On November 16th, the Electricity (Supply) Bill was formally read a first time in the Lords. The second reading was taken on November 23rd.

The Electricity Commissioners.—On November 16th, Mr. HARRIS asked the Minister of Transport how many Electricity Commissioners had resigned since the authority was first appointed; what had been the reason of their resignation; and what were the terms of their appointments.

Colonel ASHLEY said that the answer to the first part of the question was two. In both cases the reason for resignation was the desire of the Commissioner to take up an important appointment with an electricity supply company. As regarded the terms of the Electricity Commissioners' appointments, he referred Mr. Harris to the first section of the Electricity (Supply) Act, 1919. The two Commissioners in question were whole-time officers holding office during His Majesty's pleasure.

Cost of Rural Telephones.—Sir W. MITCHELL-THOMSON informed Mr. M. Wilson that the average cost of erecting in a rural area a mile of light pole route carrying a double-wire subscriber's circuit was about £90. The cost of poles, stays and arms was £25; wire about £4; insulators and spindles about 30s.; freight and handling £4; labour £41; supervision and administration charges, &c., including accommodation, about £14. As a rule, about five men were employed and the work occupied about 11 days, but this varied greatly according to local circumstances.

The Cornish "Beam" Station.—On November 17th, Mr. Pilcher asked the Postmaster-General whether he had any information regarding the interference with ordinary wireless receiving which had resulted in Cornwall from the operation of the new "beam" system of communication with Canada; and whether, if so, he would approach the Marconi Company, with a view to the protection of the interests of owners of private receiving sets.

Sir WM. MITCHELL-THOMSON said he was informed that the operation of the Post Office "beam" station at Bodmin did not interfere with broadcast reception in Cornwall, provided that suitable receiving apparatus was used. Some interference had been experienced by persons in Cornwall conducting experiments in transmission and reception on short waves, but he was afraid that that might be unavoidable.

The Chiswick Super-Power Station.—On November 18th, Sir Newton Moore asked the Minister of Health whether he was in receipt of a communication from the Surrey County Council asking him to postpone giving his decision on a recent inquiry into the application from the Chiswick District Council respecting the utilisation of the riverside lands as a site for a super-power station until he had received representations from the Surrey County Council on the matter; and whether, in view of the objections of the residents of Barnes, Mortlake, Kew, Richmond, and district to the proposal to erect a super-power station on Duke's Meadows, Chiswick, affecting as it did the county of Surrey generally, and in view of the effect of such a station upon Kew Gardens, consideration would be given to the possibility of substituting some other site in another part of the country.

Mr. CHAMBERLAIN said that the answer to the first part of the question was in the affirmative, but he was afraid that he could not postpone his decision. Full opportunity for making representations and objections was given at the recent public inquiry, which lasted several days, and the representations then made, including the suggestion in the question, were receiving his consideration.

Broadcasting.—On November 19th, on the second reading of the Consolidated Fund Bill, Mr. Day raised the question of broadcasting, and argued that it was unfair that owners of crystal sets should have to pay the same licence fee as owners of powerful valve sets. Was the Postmaster-General looking after the licence fees for portable sets?

Lord WOLMER, the Assistant Postmaster-General, said that the Post Office was taking very elaborate measures to see that licences were obtained. Experienced and able officials were devoting their whole time to the matter, and their activities had resulted in a marked increase in the number of licences taken out. He was not going to tell Mr. Day how portable sets were detected, but they were being detected. Up to date 430 successful prosecutions had taken place, and others were pending. The idea of making licence fees for crystal sets lower than the licence for powerful sets had been very carefully considered, but its enforcement would cause a great deal of friction and administrative difficulty.

Electrical Gifts for Christmas.—I.

WITH Christmas only a month ahead, thoughts are again turning to the troublesome problem of suitable presents. There can be no more suitable present for an electrical man to give or receive than an electrical appliance of some sort; indeed, to go farther, there can be nothing more acceptable to anybody, for electrical gifts offer a very wide choice to suit all tastes and pockets. With this in mind we are again offering a few suggestions, and hope that these will stimulate the ideas of our readers, both as dealers and as customers.

The first of our suggestions takes the form of a fire possessing useful and novel features. This is the "Meracol" fire illustrated in fig. 1, and made by the Thermopath Co., Ltd., 59, New Oxford Street, W.C.1. It serves a dual purpose, being at the same time a fire-screen and a screen-fire. It consists of a polished copper bowl reflector in a metal frame, mounted on substantial feet. A notable feature of the fire is the way in which the element is mounted. It is secured to its base by means of a special cement which keeps it rigidly in position, although gripping only a small portion of the spiral. Moreover, the position of the element and the shape of the bowl are such that every part of the coil is in focus, and by this means the maximum direct radiation is obtained. The back of the bowl has a bright finish, and the metalwork absorbs but little of the heat. The construction of the element is peculiar, consisting of a spirally-wound wire made up into a larger spiral, and the methods adopted cause this spiral to be reflected in the bowl in a very attractive way. The loading is 600 W and the diameter of the bowl is 13 in. The framework is finished in antique brass or copper or oxidised silver.

Fig. 1.—The "Meracol" Screen Fire.

The Sun Electrical Co., Ltd., supplies the iron shown in fig. 2. It is fitted with most of the devices for facilitating its use such as the thumb rest and means for standing the iron in a vertical position. It has a highly nickel-plated finish, it weighs 5¼ lb., and the loading is 420 W. Another "Sunco" device is the kettle depicted in fig. 3. Apart from its rather unusual shape, the method of fixing the heating element (of the immersion type) is novel. The general rule is to insert these heaters horizontally, but, as will be seen from the illustration, the "Sunco" element is fitted in the bottom in a vertical position. The kettle has a capacity of 2¾ pints and a loading of 500 W. It is nickel plated.

Fig. 2.—The "Sunco" Iron.

Fig. 3.—The "Sunco" Kettle.

Among the electric fires which are available as suitable and seasonable presents is the "Revo Radiant" type made by the Cable Accessories Co., Ltd. This fire (fig. 4) has non-metallic rod elements mounted focally in a copper reflector. The brightness of the elements provides light as well as heat. The fire is finished in nickel-plate and copper. Another very different line of the company is radio apparatus which, no doubt, will form an important section of the Christmas trade. We illustrate one of the "Revo" range of loud speakers (fig. 5) which can be supplied in a number of styles to harmonise with furnishing schemes or personal predilections.

Fig. 4.—The "Revo Radiant" Fire. Fig. 5.—A "Revo" loud speaker.

Another electric iron is shown in fig. 6. This has the double advantage of being able to be packed flat and of being suitable for a wide range of voltages. It can thus be conveniently carried about by travellers. When it is closed up it only takes up a space measuring 5¾ in. by 2¾ in. by 1¼ in. It weighs 2¼ lb. and has a 200-W element. The iron is a product of the Siemens & English Electric Lamp Co., Ltd. Another "Siemens-Xcel" appliance is the "Utility" table cooker shown in fig. 8. By its use a number of culinary operations can be carried out near the "point of application," that is, at the meal table. It is made with either one or three "heats," the maximum loading being 650 W. A third example of "Siemens" products suitable for Christmas gifts is the set of automobile bulbs illustrated in fig. 7. These are in a handsome case and would be very acceptable to a motorist.

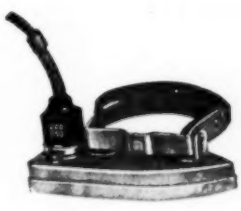


Fig. 6.—A Travelling Iron.

Fig. 7.—Automobile Lamp Spares.

Fig. 8.—The "Utility" Table Cooker.

The B.E.A.M.A. Dinner.

The Electricity (Supply) Bill, and Power in Industry.

The annual dinner of the British Electrical and Allied Manufacturers' Association (Inc.) was held on November 17th at the Connaught Rooms, London. The president, the Rt. Hon. the Earl of Derby, K.G., was in the chair, and there was a very large attendance of members and guests, about 700 in all.

After the toast of "The King," given by the president, Col. R. K. Morcom, C.B.E. (chairman of the Council), proposed "The National Development of Electricity Supply." He said it was well to be quite clear as to the meaning of "National." Did it mean "of the nation," "by the nation," or "for the nation?" If it meant merely "of or for the nation," then in that assemblage of electrical manufacturers and their friends it should prove popular, but if it meant "by the nation" in the sense of "nationalisation," then he knew it would fall flat. So he would make "by the nation" mean "by the manufacturers of the nation." He rather felt that "the natural development of electricity supply" would have been a more congenial sentiment; but the nation insisted on being in the picture—so "National" it must be

This insistence was shown by the anxiety of every political party to take the electrical industry under its wing. Whether the industry was quite as eager as the foster-mother was another question; it was a healthy fledgling, and might have fared quite well alone.

Obviously, this maternal instinct was aroused in the political breast by the intimate association of electricity and the standard of living. In the domestic sphere, the cleanliness and convenience of electricity commended its use to every housewife. He recalled the sense of misery felt in an unelectrified house as the hand wandered over the unsympathetic wall-paper, feeling for the switch which was not there; they and the Government were at one in their determination that no such house of sorrow should exist. Then in transportation, every railway traveller longed for the day when he would be able to eat a meal on the train without a condiment of coal-dust, or open a window without fear of a cinder in the eye. That day would come when those responsible for the finance of our railways could solve their financial equation. Meanwhile, both great branches of the electrical industry were adding weight to their side of the balance by improvement in manufacture and by improvement in generation. When the scale swung over they might rest assured that the great railway load would come in, to the benefit of the nation's electrical load factor. But, great though the value of electricity in the home or on the road, it was in industry that its potentiality for good was greatest.

The true measure of national efficiency was output per man per hour. Without ample power that measure could never reach its highest. It was as the paramount agency for the distribution of power that electricity made this age its own. Whether by increase in private plants or in public supply, the organisers of industry must see to it that more and more power was put behind the workmen; otherwise they would be unable to improve, or even to maintain, the standard of living of their people.

Such were the considerations which linked electrical development with public policy. To make the link still closer, the new Electricity Bill had been propounded. Like much modern legislation, the Bill was an emanation from a morass of figures. To leave the firm road of first principles and wallow in a quagmire of statistics had, of late years, become a legislative habit, despite the fact that government by statistics was notoriously unprincipled and frequently unmoral.

Coupled with statisticomania was commonly found a child-like faith in so-called "experts." A very torpedo to demolish adverse criticism was to cry: "An expert says so." In the present instance figures and experts combined to demonstrate the backwardness of electrical development in this country. To manufacturers, this seemed "good medicine." Unfortunately, the man in the street, and others who ought to have known better, deduced some failure on the part of the supply industry. This was unjust, for in the face of harassing surrounding conditions the industry had done marvellously well. He suggested that the flow of electricity in a community, as in a cable, depended not only on the voltage, but also on the resistance and the capacity. They could rely on the supply industry to maintain the voltage, if only the Government would reduce the resistance, and the consumer would increase the capacity. A safe motto for all who wished electricity well was: "Look after the demand, and the supply will look after itself." Considering the activity of the demand and the professed goodwill of the Government, the future of the supply side of their industry looked rosy. If for no other reason, they owed the Government a deep debt of gratitude for a magnificent free advertisement.

Turning from the supply side to the manufacturing side, Col. Morcom said he recently attended a meeting of the World Power Conference, and took the opportunity of discussing electrical matters with engineers of many nations, and of visiting works in several countries. He returned convinced that the electrical manufacturers of this country were second to none in design, in equipment, and in organisation, and better than any in the quality and reliability of their products. But he could not help feeling that in other countries there was a closer sympathy between Governments and manufacturers, a closer relationship between finance and industry, and a closer co-operation between consumer and producer than in this. There was a keener realisation of the essential need for parallel development of manufacture and use.

National development of electricity was only half development unless the nation's factories made the plant. They would have noticed on the menu the new badge of the BEAMA; he would interpret its allegory. The lady was the genius of electricity pointing the ship of progress towards the light. As a protection against persons of evil intent, she carried the BEAMA shield. Before her floated the little angel of BEAMA publicly to warn obstructors from the fairway.

They wanted all their friends of kindred associations and Governments, Home and Dominion, to row, if not in the same boat, at least in the same fleet; they hoped to hear from Sir Douglas Hogg that the Government ship was going to join the Argosy.

On the third reading of the Electricity Bill, Colonel Moore-Brabazon said the ship was leaving the slipway of the Commons to be equipped for service in another yard. They had watched its construction with deep interest, not unmixed with apprehension, from the keel plate of the Weir Report to the final rivet. To some of them the lines of the hull did not seem to suggest a speedy craft, to others the steering gear seemed very experimental; if the guiding genius was the spirit of the Electricity Bill, they wanted to be assured that her finger would point in the right direction. He supposed it was too much to hope that the equipment would include some shield of "protection."

The BEAMA Badge.

Responding to the toast, Sir Douglas Hogg, K.C., M.P., the Attorney-General, said that in the House of Commons he was primed with information by some of the greatest experts that could be found, but that evening the Electricity Commissioners who were listening had given him no briefs, and the only colleague who was with him suggested that he should talk about gas. Asked to defend the doubtful lines and wobbly steering gear of the ship, he would remind them of their own "BEAMA Book," in which it was stated that disorganisation and lack of a common policy were a chief cause of the depression of industry, but they did not despair of the future if they were given a fair chance. The necessity of co-operative action was more than ever clear—and that described the purpose and effect of the Electricity Bill. It was proposed by that measure to remedy disorganisation, to create and give effect to a common policy, and to do that by an appeal to the principle of co-operative action.

It was fair to remember that the electricity supply industry had had a great deal of legislative interference to break down. In this country they were suffering the fate of pioneers; one of the first nations to appreciate the value of electricity, they incurred the necessary result—development in parochial areas, and the erection of generating stations without regard to the main principles on which electricity could be cheaply generated. As a direct result of that dangerous policy over 500 stations had been built instead of 50 or 60. The Government desired to assist the electricity supply industry to correct those early mistakes—to do away with the waste of capital due to low load factor and excess of stand-by plant, and thereby bring about a cheapening of the cost of generating electricity

They had been careful to avoid touching the distributive side of the industry, and left it in the hands of the existing authorities. By lowering the generating costs they could ensure that electric power would be more generally used in this country. Electrical power was the weapon with which they could best meet foreign competition, even without "protection." Why was electricity not used in agricultural districts? The transmission lines running through small villages and towns would supply electricity to them where otherwise there would be no chance of a supply. They would also encourage manufacturers to adopt mass production, which meant cheap production. Already the electrical industries showed a large export balance (11 millions), and they would be encouraged to further develop foreign markets. The increased demand for electrical appliances of all kinds would reduce the cost of production. When the Bill became law they might see the revival and growth of the use of electricity in this country, so that this would no longer be the worst of the industrial countries, as shown by the statistics. The Bill would bring prosperity not merely to the electrical industries, but to the whole country. In conclusion, he paid a tribute to the enlightened policy of the members of the BEAMA in connection with research and education.

Proposing the health of "Our Guests," Lord Derby said he believed in the development of the British Empire by the British; he considered Mr. Gepp's work of the greatest advantage, both to the Australian Commonwealth and to themselves at home.

Responding, Sir ALFRED MOND, Bart., M.P., chairman of the National Fuel and Power Committee, remarked that last year, as the president of the Institution of Gas Engineers, he was working on behalf of the gas industry; but the gas and electrical industries were not antagonistic, but complementary to one another. No one who had studied modern progress would underrate the value of electricity in fuel economy. Recently he visited the new hydroelectric station of the Government of Ontario at Niagara; the use of electricity in Canada and the United States was on a scale of which we had as yet no idea—on washing day in Toronto, electric irons gave a load of 10,000 h.p. There would be an enormous expansion of electricity in this country; many thought we could not develop electricity without water-power, but they could get it as cheaply from coal at Buffalo as from water-power from Niagara. There was no reason why we should not be able to develop cheap electricity supply.

Mr. H. W. GEPP, chairman of the Migration and Development Commission of the Australian Commonwealth, also replied to the toast, remarking that organised industry was the key to the future of the British Empire, and incalculable benefits would be derived from the future operations of the Electricity Commissioners. The Imperial Conference was an outstanding example of co-operation; it was the first at which a special committee on research was reporting directly to the plenary meeting. The report was encouraging to all who had been pioneers in this direction; the work of the B.E.S.A. was fully recognised, and should be assisted by further grants. The World Power Conference had directed attention to the importance of power; those industries which used the largest amount of power produced the greatest amount of wealth. In Australia they were considering the extension of power supply to the rural as well as the industrial districts. Students from Australia trained in this country would return to it in the future for machinery and counsel. Referring to the huge market offered by Australia for electrical goods, he said they were anxious to increase trade with the Home country.

"The Chairman" was proposed by Sir PHILIP CUNLIFFE-LISTER, K.B.E., M.C., M.P., President of the Board of Trade, who said the essentials to success were certainty as to where they stood, and the capacity to go ahead. Lord Derby was a great dynamic force; as long as the B.E.A.M.A. carried his colours, everyone would back it for a winner. The toast was accorded musical honours.

Lord DERBY, in responding, said he would offer no opinion on the Electricity Bill—but once it was the law, it would be their duty to respect it to the best of their ability; they might seek to alter it by constitutional means, but should all do their very best to make it a success.

In addition to those named above, there were present Sir Chas. Parsons, Major-Gen. Sir Philip Nash, Sir Richard Glazebrook, Sir Benjamin Longbottom, Col. Sir Joseph Nall, Sir Robt. Hadfield, Sir Hugo Hirst, Sir Max Muspratt, Sir John Snell, Dr. W. H. Eccles, Mr. H. C. Levis, Sir Frank Heath, Mr. E. Garcke, Sir George Sutton, Mr. O. H. Smith, Mr. J. B. Atkinson, Mr. R. W. L. Phillips, Sir Philip Dawson, Mr. G. Balfour, Mr. W. O. Smith, Mr. W. Rutherford, Mr. C. P. Sparks, Dr. S. Z. de Ferranti, Dr. A. Russell, Col. R. E. Crompton, Lord Vaux of Harrowden, Mr. D. N. Dunlop, Sir Harry Haward, Col. T. F. Purves, Mr. W. W. Lackie, Mr. T. P. Wilmshurst, Mr. G. Scott Ram, Mr. D. A. Bremner, Mr. J. W. Beauchamp, and many other leading representatives of the profession and industry.

Industrial Standardisation.

A Report to the Imperial Conference.

THE General Economic Sub-Committee of the Imperial Conference, reporting on the subject of Industrial Standardisation, stated that using the term "standardisation" in the broadest sense to include, for instance, what is sometimes termed "simplification," it was impressed with the advantages which accrued alike to the manufacturers and to the buyers of the goods to which the principle of standardisation was applied. As an illustration, it was mentioned that the reduction, resulting from standardising, in the number of iron and steel sections produced in Great Britain, from some hundreds to 113, was estimated to have resulted in a saving of cost of production of 5s. per ton over all sections rolled, which would be equivalent to about half a million pounds sterling per annum. Further, the value of the stocks of electric lamps held outside factories in Great Britain was said to approach some four millions sterling, and it was believed that the unification of standard pressures would cut down this sum by at least one-half.

The principle of standardisation was not to be applied indiscriminately. In particular, it was important to beware of the risk of impeding technical progress, and to see that suitable provision was made for adequate revision.

A considerable amount of progress had been made within the Empire, both in the extension of standardisation and in securing common standards. In Great Britain and Northern Ireland, Canada, Australia, South Africa, and India there were Engineering Standards Associations, working upon similar lines and in conjunction with the scientific and other interests concerned, and in New Zealand and the Irish Free State, where there were no standardising authorities, the standards issued by the British Engineering Standards Association were generally used. Between the Associations overseas and the Engineering Standards Association in Great Britain there was already a substantial amount of co-operation. Much had also been done by public departments throughout the Empire to profit from standardisation; but much more could be done to the advantage of trade within the Empire, as well as of its trade with the world at large. There were many branches of industry to which the principle of standardisation had not been applied at all, and to which its applicability had apparently not even been considered; and where standard specifications had been set up, the practice of standardisation had in many cases not been followed to the extent which might have been expected.

Up to now there had been little or no propaganda, and the movement could be assisted by more active interest on the part of Governmental authorities in many parts of the Empire. There was no provision for the exchange between the various parts of the Empire of information as to what was being done or contemplated in respect of standardisation. There appeared to be good prospects of benefiting producers and consumers alike, and further promoting trade within the Empire, by increasingly establishing standardisation on the broad basis of Empire markets as a whole, where this was found feasible after a study of local needs. Consequently, steps should be taken to extend the co-operation in respect of standardisation which already existed. To these ends, it would seem desirable that in Great Britain and Northern Ireland, and in each of the Dominions and India, some Department of Government, or some authority working in co-operation with Government, should be charged with the duty of watching and stimulating the standardisation movement, by whatever means each Government deemed best, and of providing for co-ordination, including the collection of information and its communication to the other parts of the Empire.

In order to prevent any misunderstanding, the Sub-Committee made it clear that there should not be anything in the nature of the determination by Governmental authority of industrial standards, except in the case when Government buying departments laid down their own standard specifications for their own purchases. If the standards were to obtain general acceptance, they should be framed only by representative bodies of producers and consumers, though the help of Government research institutions should be available wherever and whenever desired. Further, it was not proposed that the work of the various standardising bodies should be interfered with in any way. So far as they were concerned, what the Sub-Committee had in mind was more active and regular Government interest in their work and their utilisation to the fullest possible extent.

The Sub-Committee recommended for the consideration of the Conference the adoption of the following resolution:—

"The Imperial Conference, recognising the advantages of standardisation in its widest sense both to producers and to consumers, and appreciating that when it is practicable to adopt standards common to the Empire, these advantages are augmented and great benefit results to trade within the Empire and Empire trade generally, recommends to the favourable consideration of the several Governments of the Empire that they should take steps to promote the further development of standardisation, should arrange for the exchange of information with the other parts of the Empire, and, when common standards are possible and mutually advantageous, should co-operate with the other parts of the Empire in regard thereto."

Shop Window Display.

The Second E.D.A. Conference.

AT the second E.D.A. Conference, held at the Royal Society of Arts, on November 19th, Mr. E. Willson (president of the British Association of Display Men) gave a lecture on "Shop Window Display." The chair was taken by Mr. H. T. Young, of Messrs. Troughton & Young, in the unavoidable absence of Major H. C. Palmer, of the General Electric Co.

Mr. WILLSON, who is in charge of the shop window display department of Kodak, Ltd., said he belonged to an Association which had for its sole object the betterment of window display throughout the country. The early part of the lecture was devoted to a discussion of the scientific principles underlying the art of window display, and in order to drive home the point that the fundamental principles are balance, simplicity and the use of lines, examples were shown on the screen of famous pictures, such as "Bubbles" by Millais, and many others by other well-known artists, with the object of emphasising how shop window display must have an artistic conception behind it. In spite of the advances which had been made there were still many examples of bad shop-window dressing. Moreover, there was far too much sameness in the dressing of windows of similar shops in the same locality.

He would no doubt be asked how to dress a window with electrical goods, but, frankly, he must say he could not give any ideas which could be regarded as of general application. The locality and the particular goods to be sold must be taken into consideration, and so it was impossible to give a general formula. However, it could be said that nothing had ever been made which could not be properly displayed. The chief point to be borne in mind was that every display should be made to tell the story of the goods displayed, and

that was true, no matter whether the article was ladies' clothing or electric stoves. Electricity lent itself to the telling of a very interesting story, but it seemed to him that a good many windows which purported to display electrical goods and ought to make the passer-by want to use electricity, had the very opposite effect. The window might be telling a known fact, but that did not matter. The object must be to attract attention to the shop and induce the passer-by to stop, and one of the most effective means of doing this was simplicity in the method adopted. If the display were largely by showcard, then all forms of fancy lettering or showcards put at all sorts of angle in the windows, with the idea of balancing one side of the window against another should be avoided. It must be made possible for the passer-by to read the showcards in a natural position. The display should consist of only a few articles with only the essential facts about them, otherwise, as in the case of many window displays in the electrical trade, there was too much reading matter for the passer-by to assimilate, and he lost interest in the window and soon forgot all about it. Another important point was that the retailer should link up his display with national advertising if he wished to reap the full benefit. For instance, some time ago he saw, for the first time, a large advertisement in a daily paper of "Rawlplugs," and it at once occurred to him that he could do with some in his home. However, he forgot all about the advertisement, and for many months he did not see "Rawlplugs" displayed prominently in ironmongers' windows. The result was that he did not buy any for nearly a year after he saw the national advertisement. Speaking generally of electrical window displays, Mr. Willson was unable to commend the great majority, although he had a good word to say for some of them. Incidentally, he mentioned in connection with his work as a judge in Shopping Week competitions in various parts of the country—in which window display competitions found a place—how few electrical shop windows were entered, whereas there were a very large number of excellent gas window displays. His observations of electrical shop windows throughout the country had led him to regard them mainly as efforts at hanging fittings from the ceiling without any idea of arrangement or any regard to colour, without any balance and, indeed, without any object in mind except to put things in the window. A large number of lantern slides of electrical displays were shown on the screen, and Mr. Willson gave an interesting critical examination of them, pointing out where they failed and where they were good.

The Chairman, in opening a short discussion, said that some of the window displays that had been shown on the screen were those of his firm, although he was not aware, before coming to the lecture, that they were to be shown. He felt he could take some pride in the fact that some of these displays had been entered for competitions and had won first prizes. He himself had adopted the plan of endeavouring to ascertain to what extent window displays influenced sales, and in this way it was possible to tell, within a little, the type of window display which was most effective. For instance, he had found it paid to put groups of electric irons or electric fires in the window; it was necessary to put in a little more descriptive matter than was required for some other classes of goods.

Mr. L. GASTER said he had hoped the lecturer would have said something about efficient window lighting because that was an important factor in the success or otherwise of a window display.

Mr. V. W. DALE said he was interested in the remark of the lecturer as to the need for retailers linking up their displays with national advertising because that was very much to the point in connection with the present E.D.A.-E.L.M.A. campaign. A window fitting, showing the competition house, had been prepared at a cost of 35s., and already 120 had been sold. That might be too expensive for some of the small firms, but it was hoped that a very large number of them would be used. In addition, 1,400 art prints of the competition house for display purposes had been sold, and it was also hoped that a great many more would be disposed of. Moreover, it had been decided that day to go ahead with the preparation of a model of the competition house so that it could be placed in windows and lighted. Although the models had not yet been actually made for sale, orders had been received for 130 of them.

The Chairman, in proposing a vote of thanks to the lecturer, urged that there should be closer co-operation between the E.D.A. and the British Association of Display Men.

Swiss Railway Electrification.—The electrification of the Federal Railways in Switzerland is going on vigorously. The sockets for the overhead line masts between Puidoux and Chiètres are finished, and the masts themselves are being raised between Chiètres and Deitingen. The iron bridge over the Mionnaz, between Palézieux and Oron, has been replaced by a masonry one, as has also the one at Guin, while the bridge over the Singine, near Flamatt has been rebuilt of reinforced concrete. Various stations are being enlarged and transformed, and amongst the more important ones may be mentioned Neuchâtel, Delémont and Fribourg. By the end of June the C.F.F. had invested in yet another eleven new electric locomotives, bringing the total number up to 260 in all. The 5½ per cent. first mortgage loan on the electric power stations of the Lonza has met with great success.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Variable-speed Three-phase Motors.

I shall be glad to have the opinions of readers on the following problem:—

I wish to run a fan for compressing gases at anything between 800 r.p.m. and 2,000 r.p.m. The makers of fans do not consider that the speed variation can be got with a three-phase motor, and they do not recommend commutator motors with brush-shifting gear.

One method proposed is to use expanding cone pulleys, and it will be useful to know how these have operated in practice.

The maximum power of the motor will be approximately 40 h.p.

Variable Speed.

November 17th, 1926.

Wiring for Domestic Appliances.

May I suggest that your contributor "H.B." (page 786) and your correspondent "P. M. Braidwood," both miss the vital point of combining low cost with safety in connection with domestic electrical appliances. The contractor who can visualise what some future tenant will do with an installation is not of this world, and his most conscientious efforts are more than likely to prove a ghastly failure.

There is no perfect way of dealing with this subject of wiring for such appliances as radiators, kettles, vacuum cleaners, irons, &c., but the following approaches it.

Supply authorities should lay it down that the carrying capacity of cables used for power circuits of this nature should conform to a scale based on the number of points (plugs) fitted.

Then every *appliance* should be fitted with its *own fuse*. The latter is a most necessary reform, and supply authorities and insurance companies should insist on it. Many accidents would be averted and wiring made just a little cheaper and simpler.

I know the "snag" in it. Some consumer somewhere will replace the fuse of, say, the domestic iron with a piece of 14-gauge steel wire—but then, he deserves to get burnt.

As to the supply of domestic appliances, manufacturers and supply authorities do their best. Over 20 years' experience shows me that such "gadgets" are not *sold* by contractors—they are *bought* by consumers. The average contractor knows as much about how to sell domestic appliances as the proverbial cow did about side pockets. When the consumer says he wants an electric iron then the contractor will sell him one, but the average contractor has not the shadowiest notion of how to teach the consumer what he ought to have.

Someone has said: "The art of salesmanship is to sell a man what he doesn't want at a price he can't afford." Without going as far as that, it is possible to use a little persuasion.

Just one other point: Why cannot supply authorities make a feature of giving free schedules of what the installation should comprise, to intending consumers, leaving it to the latter to supply all contractors tendering with a cut-and-dried plan? If this meets with the remark that it would destroy the initiative of the contractor—the answer is "bosh." He hasn't got any and never had any. His life-work is to so cut the job that his price will be the lowest and he will get the order.

S. A. Curzon.

Croydon, *November 15th*, 1926.

Wiring the Homes of Britain: An Appeal.

When a house is built the gas and water pipes are fixed as part of the builder's work. Later, the occupier gets his gas and water, as and when required, without any vexatious rules and restrictions.

It is claimed by the writer that the same may be done in the case of electricity. Further, that every claim as to the expediency, safety, and simplicity of such a service was equally well demonstrated forty years ago. It would be unwise to go into history at this stage, but the writer challenges contradiction. The builder should be in the position that he holds with gas and water, and be able to say to the cable makers: "I want this list of stuff delivered at so-and-so"; his men should receive it, fix it, test it, and leave it, and any further test should be purely at the option of the supply people.

The many different systems of wiring now in use should be cut down to one, and that, the only really safe one, the concentric system with the outer earthed. It is really safe because the pressure wire is safely enclosed inside the concentric, earthed outer. To put the case even more strongly, it is claimed that nearly the whole of the troubles met with in wiring are due to surface leakage from the two-wire system now in use.

To use a 5,000-meg. cable, cut into the insulation, and attach the conductor to a terminal mounted on a hygroscopic insulating base, is a screaming farce. In the concentric system, every terminal or other live attachment would be enclosed in an earthed (by the outer) air- and water-proof fitting. The question of continuity of the outer does not arise because such fittings would do their work automatically and safely.

It has been effectually proved by the earthed return of the tramways and railways for over a quarter of a century, that

the electrolytic danger has been grossly magnified, and that by people who should have known better. They did know better, in fact, but foolishly surrendered their faith to the ill-advised interference of the fire offices. Too much reliance has been placed on fire-office rules. The contractor flourishes them at us and under their protection uses the design of wire and fittings that is the cause of most of our troubles.

Much fuss has been made of "standardisation," but surely, the very first thing to be standardised is the conductor. Is it not a very grave charge against the profession that after nearly half a century of experimental work it has not arrived at a standard system. With this as the main point, an appeal to every grade of the profession is now made for consideration. Without it, the "Homes of Britain" will have to wait a long time for cheap, safe wiring.

E. G. Pink.

London, *November 16th*, 1926.

Overhead Transmission Lines.

May I add a few remarks to Mr. Logan's excellent article which appeared in your issue of November 12th?

Mr. Logan shows very clearly how, by improving the foundations of an A pole, the sag of conductors, instead of the transverse load, may determine the span length. He points out that a 45-ft. pole, sunk presumably 7 ft. 6 in. in the ground, is capable of taking the transverse load of a 0.1-sq.-in. copper line with 800-ft. spans, but on account of the sag the span must be limited to 475 ft.

By the use of Herringbone pole arms and 3-ft. spacing of conductors, a further 18 in. of pole height becomes available, which increases the permissible sag to 15 ft. and the span to 500 ft. (as shown in Mr. Logan's fig. 1).

Part of the increased strength of foundation is due to sinking depth, and no useful purpose is served by sinking the pole to a greater depth than will give a foundation strength corresponding to an increased span length and sag made possible by leaving a greater height of pole above ground.

In the instance chosen for illustration this depth is about 6 ft. 6 in. The sag may now be increased to 16 ft. and the span to 520 ft., which reduces the number of poles per mile from 11 to 10 and the cost given in Mr. Logan's table from £308 to about £280.

If a horizontal crossarm were used (as represented in Mr. Logan's fig. 2) reference to fig. 17 in the writer's article in the ELECTRICAL REVIEW of October 15th shows that conductors of 0.1-sq.-in. copper would require greater spacing than sag to place them beyond the possibility of clashing, but with Herringbone pole arms 3-ft. spacing gives a good factor of safety with 16-ft. sag.

These further advantages are probably worth adding to Mr. Logan's already greatly improved pole.

Wm. E. Poole.

London, *November 20th*, 1926.

Referring to Mr. E. A. Logan's article on "Overhead Lines" in the ELECTRICAL REVIEW of November 12th, it would be interesting to know the horizontal spacings recommended for 0.05 and 0.1-sq.-in. conductors for the spans suggested as the most economical.

Would Mr. Logan say on what basis these spacings are computed, and whether he has used them long enough to be satisfied as to their safety?

R. F. M.

November 19th, 1926.

The Rent Meter.

Having had an opportunity of reading a leaflet describing the above meter, I have read with interest the answers given by Mr. Amberton to "Anticreep" in your issue of the 12th instant.

While not wishing to enter into a controversy regarding the merits or demerits of the performance of such a meter, I would like to deal with one or two points that the meter engineer will be up against if such a meter is installed on an existing supply where a two-part tariff is in use.

I am fully aware of the necessity for a meter that will accurately record the consumption at low loads and at the same time provide for a wide range of load, such as is met with amongst domestic consumers.

Under the heading "Object of Rent Meter," Mr. Amberton points out the advantages that the meter has over the two-meter method, and the large-capacity ordinary meter, but also states that the constant rotation "is a convenient means of recording the fixed part of a tariff."

Take, for instance, a tariff having a fixed charge based on the net ratable value of the house plus a flat rate per unit, and assume that it is proposed to supersede this method of charging by installing a rent meter. Hitherto, the determining of this fixed charge has been no concern of the meter tester, but now, it would appear, he has to ascertain the ratable value of the premises where the meter is to be installed before he can calibrate the meter to accurately record the fixed charge.

Seeing that he hardly ever knows beforehand the particular job for which a meter is required when testing it, it is impossible for him to calibrate the meter for any particular fixed charge; hence, the meter will of necessity have to pass through his hands a second time.

Furthermore, what check have those in authority over him for knowing that the fixed charge is adequately covered, or, on the other hand, is not excessive from the consumer's point of view, seeing that it cannot be checked against a standard instrument owing to the variation of the fixed charge?

Then, again, the ratable value may be anything from £10 to £50, and it would mean that a whole series of constants would have to be kept available by the meter department, so that the meter could be calibrated to suit the particular consumer.

Also, what happens to the fixed charge when the meter stops half-way through a quarter, and how is the proportion of fixed charge to units arrived at when the date of the stoppage is not known?

There is also the case where a meter may be changed for overhaul, or other reason, and later be refixed on other premises where the fixed charge is different from which it is apparent that detailed records would need to be kept of all such meters, apart from the usual (sometimes voluminous) history which attaches to meters passing through the meter department.

I do not wish in the least to disparage the efforts of meter manufacturers to supply meters to suit all tariffs, but I do suggest that with the increasing tendency of supply authorities to adopt a two-part tariff with a view to the building-up of a domestic load, meters should be so designed as not to introduce complications in the meter itself or add difficulty to the work of a meter department, particularly in those undertakings which are handling thousands of meters per annum.

Also, in a well-organised meter department, there is enough for a meter tester to do without having to trouble about calibrating a meter for a fixed charge, nor should it be his duty to fix such a charge, which is what it amounts to with a rent meter.

I must apologise for taking up so much of your space, but I feel that with the rapid growth which is taking place in the demand for electricity, Mr. Amberton will agree with me that meter departments are becoming more and more important in electricity undertakings, and that all the assistance meter manufacturers can give them in the way of reducing complications in the design of meters, and the methods of metering, will be for the ultimate benefit of both.

P. Wardle.

Walsall, *November 15th*, 1926.

Change of Voltage.

I am at present taking current from a Metropolitan borough council at 100 volts, for lighting only. In response to numerous circulars sent from the station, I inquired about a supply for cooking and heating, and am informed that energy for these purposes can be supplied only at 200 volts. The engineer very kindly tells me that the voltage will be changed to 200 V at the Council's expense, but that I shall have to bear the cost of new lamps and any other apparatus made for the original 100 volts.

It is, of course, well known that if a supply body notifies a consumer that the voltage will be changed in consequence of general increase or what not, the supply body is bound to supply new lamps, &c., free. In other words, if the supply body elects to change the voltage for its own convenience, it must relieve the consumer of all expense. Now I maintain that I am entitled to demand as much current as I wish to use, and if the Council finds it necessary to double the voltage so as to keep the amperes down and avoid overloading its mains (which, of course, is the reason), then the onus of renewals still falls on it. The engineer, however, will not accept my contention, and things are at a deadlock.

Your opinion on the matter would be of great value to a host of readers.

Perhaps you would also be good enough to say if, in such circumstances, the Board of Trade or L.C.C. has power to decide the issue.

M. R. D.

November 17th, 1926.

[No doubt our correspondent, or his predecessor in the occupation of the house, in his original application stated the maximum power that he required; if he desires to alter that maximum, he can do so by giving one month's notice to the undertakers, and paying any expenses reasonably incurred by them in consequence of the alteration. He can then use the additional supply for cooking and heating, but cannot compel the undertakers to quote a low tariff for those purposes unless they are already supplying other consumers of the same class at 100 volts with energy for those purposes at a special tariff.

If the undertakers offer a low tariff for cooking and heating at 200 volts, of which our correspondent wishes to avail himself, it will obviously be necessary for him to change over to the higher pressure; but so long as the undertakers do not compel him to change his lamps, &c., they are not liable to pay him compensation.

The choice, then, is take supply for all purposes at 200 volts and bear the cost of replacing or re-winding 100-volt appliances; or to compel the undertakers to supply additional power at 100 volts, the cost of new services, &c., being borne by the consumer. In the latter event any difference of opinion with regard to the "reasonableness" of the expenses can be referred to arbitration.

This is our reading of the Electric Lighting (Clauses) Act, 1899, Section 28. The Board of Trade and the L.C.C. do not appear to come into the question at all; nor do the Electricity Commissioners, though if a compulsory change of voltage were proposed by the undertakers, the consent of the Commissioners would be necessary.—EDS. ELEC. REV.]

The Ironmongers' Exhibition.

THE Ironmongery, Hardware and Domestic Appliances Exhibition was held at the Agricultural Hall, Islington, last week. Upon the whole the show did not indicate an "invasion" of any magnitude by the ironmongers of the field regarded by electrical dealers as theirs. Where electrical appliances appeared they were mainly upon the stands of electrical firms.

The principal electrical exhibit was that of the Ever Ready Co. (Great Britain), Ltd., which displayed a very complete range of its products. There were dry batteries of all kinds for radio use and occasional illumination, as well as numerous examples of flash lamps, torches, automobile lamps, &c. A striking "exhibit" was a huge model of a portable lamp which was continually switched on and off. The company also had many examples of accumulators, mainly high- and low-tension batteries for radio use.

Messrs. Moss, Mackay & Co., Ltd., exhibited "non-ring" lamps and valves of Dutch origin, including all kinds of automobile lamps. An inexpensive electric iron was shown and its construction laid open to inspection. Other exhibits on this stand were a loud speaker and a number of novelties, including a very adaptable extension arm for an electric lamp.

Messrs. C. R. Marden showed the "Premier Duplex" vacuum cleaner and Johnson's electric floor polisher in operation. The first machine is of the revolving brush type and is of strong construction. The floor polisher is a machine weighing nine pounds, comprising a brush driven at 2,100 r.p.m. by a universal motor. The connecting flex is provided with a finger-tip operated switch. The makers of this polisher advertise it for daily hire, as well as for sale.

A similar exhibit was arranged by Vampires, Ltd. In this case both machines were of German manufacture. The "Dandy" floor polisher employs flat rotating brushes, one hard and the other soft, in contradistinction to the revolving cylindrical brush fitted in the appliance mentioned above. The principal feature of the "Vampire" suction cleaner is an attachment on a flexible tube for drawing dust out of inaccessible places.

Messrs. Pratt, Owen & Co., Ltd., showed two models of "Climax" vacuum cleaners. One, the cottage model, is a miniature machine which can be strapped on to the user's back and it is on this account provided with a long flexible tube and nozzle. The larger machine is also of the portable type, but in this case the body is mounted on three wheels and a longer flexible tube is supplied. The motor is of the universal type mounted on ball bearings.

Another vacuum cleaner exhibit was that of the British Vacuum Cleaner & Engineering Co., Ltd., which included the "Turbinet" portable electrical pattern, which was described in our Special Domestic Issue. The "Calto-Vac" electric cleaner was shown by the Calto Economy Grate Co. Messrs. Ackroyd & Best, Ltd., whose products were also exemplified in our special issue, had a large stand devoted to their "Hailglass-ware" for electric lighting, decorative, and utility purposes. Messrs. Beatty Bros., Ltd., again exhibited their "Red Star" electric washing machines and wringers. A collection of radio apparatus of various makes was brought together by the *Hardwareman and Ironmongers' Chronicle*; this included complete sets, loud speakers, and components of first-class quality.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 17th:—

Neco (lettering and design). No. 472,112. Class 6. Small electrical motors.—Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4.

M.A.X.; A.T.M.; The System. The Operation. The Symbol (lettering and design). No. 459,089. Class 8. Telephonic instruments and apparatus.—Automatic Telephone Manufacturing Co., Ltd.

Crown (design only). No. 470,628. Class 8. Electro-technical measuring, signalling and controlling apparatus, &c.—Die Askania Werke Gesellschaft, Friedenau, Berlin. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Adaptable (lettering and design). No. 471,333. Class 8. Dry batteries.—Frank Sandle, 63, Great Cheetham Street, West Broughton, Manchester.

Stangold. No. 473,769. Class 8. Valves for use in radio-telegraphy and telephony. No. 473,770. Class 13. Metal-filament lamps (ordinary).—A. B. Starke, trading as Bruce Starke & Co., 16, Water Lane, Great Tower Street, E.C.3.

Rheostors. No. 474,021. All goods in Class 8.—Rheostors, Ltd., 7, Waterloo Street, Birmingham.

Hi-Vac. No. 474,115. Class 8. Thermionic valves.—Cleartron Radio, Ltd., 1, Charing Cross, S.W.1.

Solart (lettering and design). No. 473,348. Class 11. Electric arc lamps, mercury-vacuum lamps, electrical surgical apparatus for generating light and heat, all for surgical or curative purposes.—I. Calvete, Ltd., 11, Little St. Andrew's Street, W.C.2.

Cellotone. No. 473,698. Class 11. Electrical appliances.—A. W. Scott, 59, Woodlands Crescent, Golders Green, N.W.1.

Lunar (lettering and design). No. 471,212. Class 13. Electric lamps (ordinary).—The Lunar Electrical Co., 37, New Street Square, E.C.4.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

16,720. "Thermionic amplifiers of high-frequency oscillations." G. M. Wright and S. B. Smith. June 29th, 1925. (260,321.)
16,786. "Primary batteries." J. W. Manley. June 30th, 1925. (260,322.)
17,041. "Thermionic valve circuits." Igranic Electric Co., Ltd., and P. W. Willans. July 2nd, 1925. (260,324.)
17,042. "Thermionic valve circuits." Igranic Electric Co., Ltd., and P. W. Willans. July 2nd, 1925. (260,325.)
18,024. "Electrical condensers." S. Silbermann. July 22nd, 1924. (237,593.)
18,523. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. July 20th, 1925. (260,330.)
18,913. "Circuits of train-lighting and similar installations and electro-magnetic switches for controlling the said circuits." J. Stone & Co., Ltd., and A. H. Darker. July 24th, 1925. (Cognate application 4,880/26.) (260,334.)
19,015. "Dynamo-electric machines." Electro-Dynamic Construction Co., Ltd., and N. Pensabene. July 27th, 1925. (260,337.)
19,021. "Coil-winding machines." E. Bowkett. July 27th, 1925. (260,338.)
19,340. "Electric lamps for bicycles and the like." W. G. Whittle. July 30th, 1925. (260,353.)
19,385. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. July 30th, 1925. (260,356.)
19,491. "Means for controllably damping an oscillating circuit." N. H. Clough. July 31st, 1925. (260,359.)
19,636. "Means for controlling electric lighting installations in railway carriages or the like." F. Trinchero. August 4th, 1925. (260,360.)
19,940. "Tanks for oil-immersed electrical apparatus." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. August 8th, 1925. (260,365.)
19,995. "Means for determining and indicating the electrical conductivity of fluids." R. E. Gillmor (S. Ruben). August 8th, 1925. (260,366.)
20,209. "Electric lamp holders." W. E. Grant and M. B. Bean. November 20th, 1924 (243,311.)
22,280. "Generating of electricity by means of asynchronous generators." Siemens-Schuckertwerke Ges. September 10th, 1924. (239,853.)
25,330. "Manufacture of electric cables." Siemens Bros. & Co., Ltd., and E. R. Hubbard. October 10th, 1925. (260,410.)
27,008. "Electric furnaces for bright annealing." Siemens-Schuckertwerke Ges. December 15th, 1924. (Addition to 242,283.) (244,427.)
27,146. "Locking devices for electric incandescent lamps." H. Francis. October 23th, 1925. (Addition to 178,612.) (260,423.)
32,372. "Headlamps for motor and other vehicles." G. A. M. Lamblin-Parent. April 7th, 1925. (250,530.)
30,790. "Valve transmitters for wireless signalling, especially for very short and for directional waves." Telefunken Ges. fur Drahtlose Telegraphie. December 6th, 1924. (244,121.)
31,197. "Mercury or other vapour electric lamps." F. Reynolds. December 10th, 1925. (260,436.)
31,341. "Wireless detectors." F. N. Birtchnell. December 11th, 1925. (Cognate application 1,701/26.) (260,437.)
31,495. "Electric motors for driving self-acting mules and working machines requiring similar changes of the driving moment." Siemens-Schuckertwerke Ges. and J. Kozisek. December 14th, 1925. (260,438.)
32,516. "Electric ignition distributors for internal-combustion engines." R. H. Josephson. December 24th, 1925. (260,444.)
32,554. "Gas discharge or high vacuum tube." Siemens-Schuckertwerke Ges. January 6th, 1925. (245,755.)
32,950. "Electric lamps." Peyton, Hoyland & Barber, Ltd., and B. R. Peyton. December 31st, 1925. (260,446.)

1926.

2,542. "Automatically reclosing circuit-breaker systems and apparatus." Igranic Electric Co., Ltd. (Automatic Reclosing Circuit Breaker Co.). January 28th, 1926. (260,457.)
3,679. "Reel or drum for electric conductors." Callender's Cable and Construction Co., Ltd., and A. Elliott. February 9th, 1926. (260,467.)
4,310. "Plate construction for electrical batteries." G. A. Howland. February 15th, 1926. (260,472.)
4,701. "Electrical circuit breakers." Metropolitan-Vickers Electrical Co., Ltd. February 18th, 1925. (247,972.)
5,617. "Electric switches for automobile vehicles." L. E. R. Murray. February 27th, 1926. (260,477.)
5,987. "Starting synchronous motors." British Thomson-Houston Co., Ltd. March 3rd, 1925. (248,754.)
6,561. "Portable electric lamps for miners." J. G. Dalziz. October 19th, 1925. (Addition to 256,923.) (259,902.)
6,958. "Manufacture of legs or connectors for wireless valves or holders." R. Checklet. March 12th, 1926. (260,479.)
7,416. "Electrical heating of rooms or buildings." R. Grierson and Grierson, Ltd. March 17th, 1926. (260,481.)
8,911. "Regulating transformers." W. Reiche and Koch & Sterzel Akt. Ges. April 1st, 1926. (260,485.)
9,331. "Supporting and cooling systems for electric devices." British Thomson-Houston Co., Ltd. April 9th, 1925. (250,605.)
10,732. "Electric signalling systems." W. K. Lewis and A. J. Anido. April 23rd, 1926. (260,497.)
10,942. "Coil supports for electric transformers and the like." International General Electric Co., Inc. April 25th, 1925. (251,299.)
10,944. "Control of electric power systems." British Thomson-Houston Co., Ltd. April 25th, 1925. (251,301.)
11,831. "Electric lamps." E. Piccoli. May 5th, 1926. (260,504.)
11,871. "Electric switches." British Thomson-Houston Co., Ltd. May 28th, 1925. (252,697.)
11,884. "Lighting fixtures." Korrectolite Co., Inc. May 21st, 1925. (252,353.)
12,113. "Plastic compositions applicable as electric insulating and acid-proof materials and for manufacturing various articles." R. H. Abrey. May 11th, 1926. (260,505.)
12,451. "Electric cables." Pirelli & Co. May 16th, 1925. (252,192.)
13,270. "Electromagnetic regulating apparatus." Naamloose Vennootschap Maschinerieen-en Apparaten Fabrieken. May 27th, 1925. (252,716.)
17,632. "Apparatus for operating Röntgen-ray tubes." Dr. G. F. du Prel. August 11th, 1925. (Divided application on 20,171/25.) (260,527.)
18,318. "Systems of electric motor control." British Thomson-Houston Co., Ltd. July 23rd, 1925. (255,881.)
22,365. "Power-generating plants." Metropolitan-Vickers Electrical Co., Ltd. September 24th, 1925. (258,858.)
22,672. "Electrical rectifying installations." Siemens-Schuckertwerke Ges. September 19th, 1925. (Addition to 244,092.) (258,592.)
23,980. "Mercury-vapour rectifiers for large outputs." Akt. Ges. Brown, Boveri et Cie. October 17th, 1925. (259,941.)

Australian Standards.—The Australian Commonwealth Engineering Standards Association has tentatively adopted British Standard Specifications for slate slabs, electric switches, and air-break circuit breakers. These have been issued and after the lapse of 12 months they will be reviewed prior to their issue as Australian standards.